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MONTANA

HIGHWAY COMMISSION



1971 REVISIONS TO 1969
STANDARD DRAWING BOOK
FOR ROAD AND BRIDGE CONSTRUCTION

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THE STATE OF MONTANA

BY THE COMMISSIONER

AND BY THE PEOPLE

STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

JANUARY 1, 1971

STANDARD DRAWING BOOK

We are sending the following additions and/or revisions effective January 1, 1971 to be included in your present Standard Drawing Book, the grey covered one, original issue January 1, 1969.

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- NOTE:
1. Add these drawings to your book.
 2. We are also sending a complete new index, pages 1 thru 8.
You should destroy the old index Pages 1 thru 6.
 3. Note several drawings have been deleted as of January 1, 1971.

Melvin C. Rygg

MELVIN C. RYGG, P. E.
OFFICE ENGINEER



STATE HIGHWAY COMMISSION
HELENA, MONTANA 59601

STANDARD DRAWINGS FOR HIGHWAY CONSTRUCTION

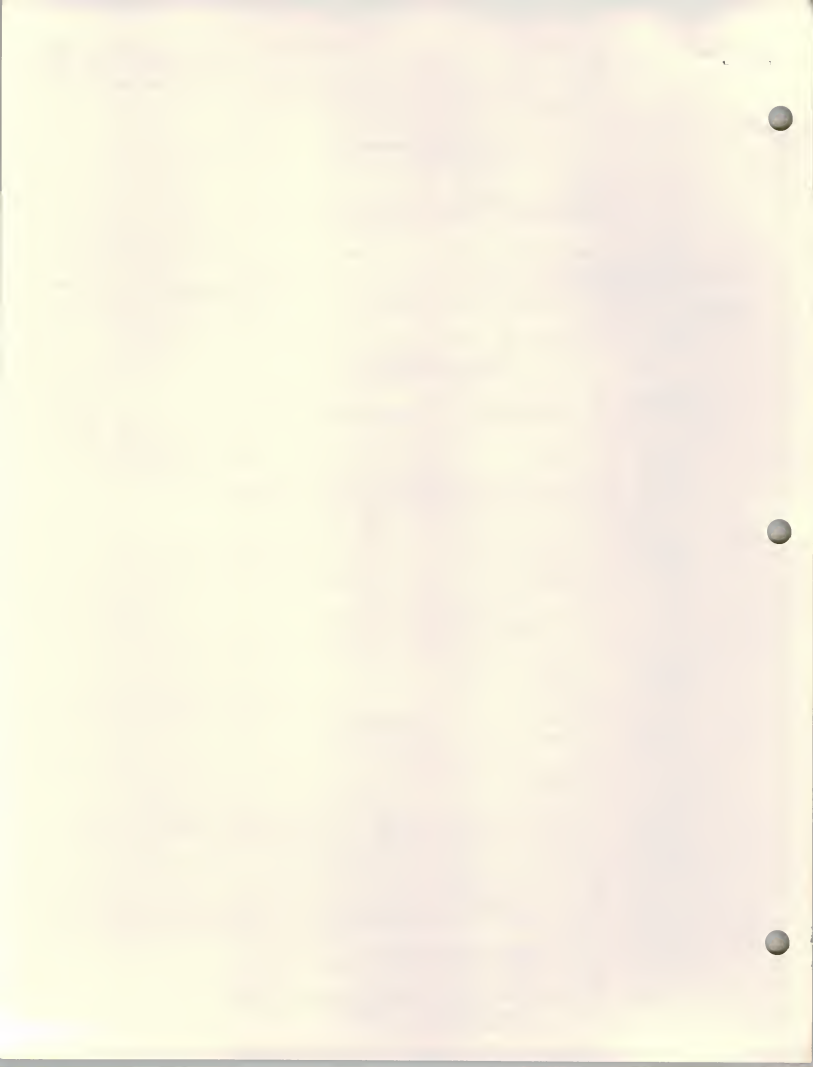
These Standard Drawings which are supplementary to the Standard Specifications become effective January 1, 1969.

In the future when revised drawings are sent, they will become effective on the date shown thereon and the superseded drawings should be retained until no longer applicable.

New drawings issued will become effective on the date shown thereon.

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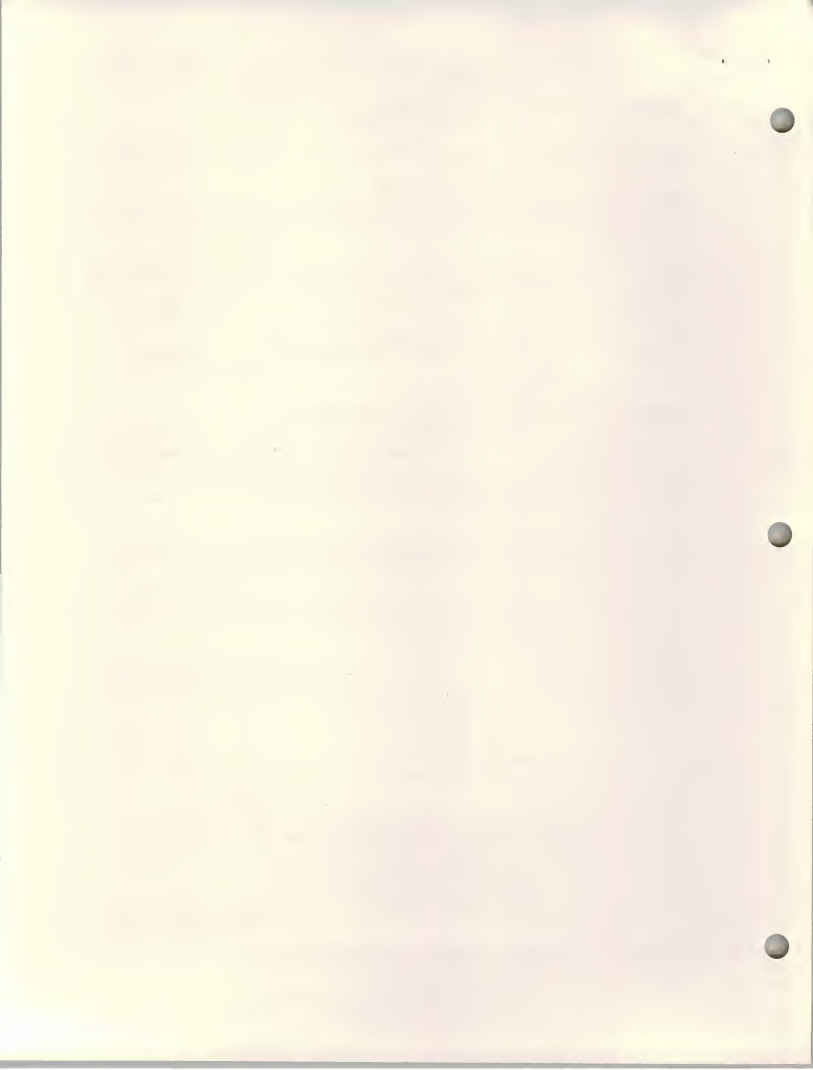
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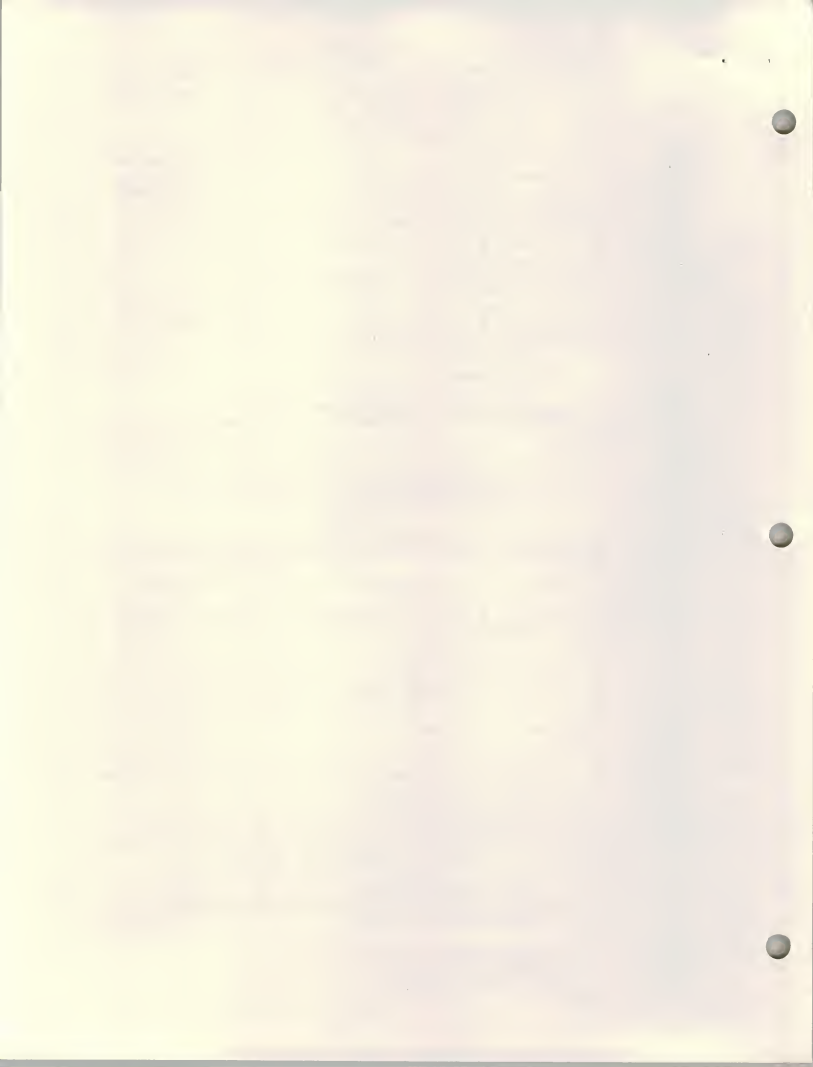
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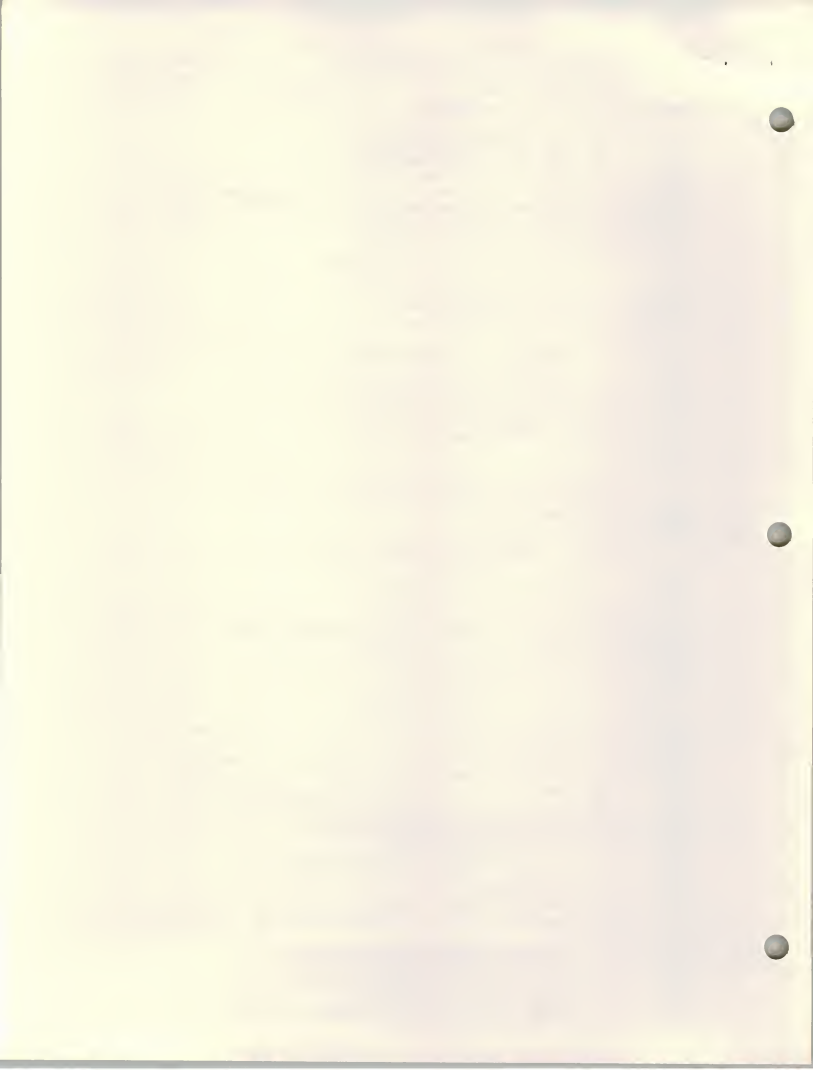
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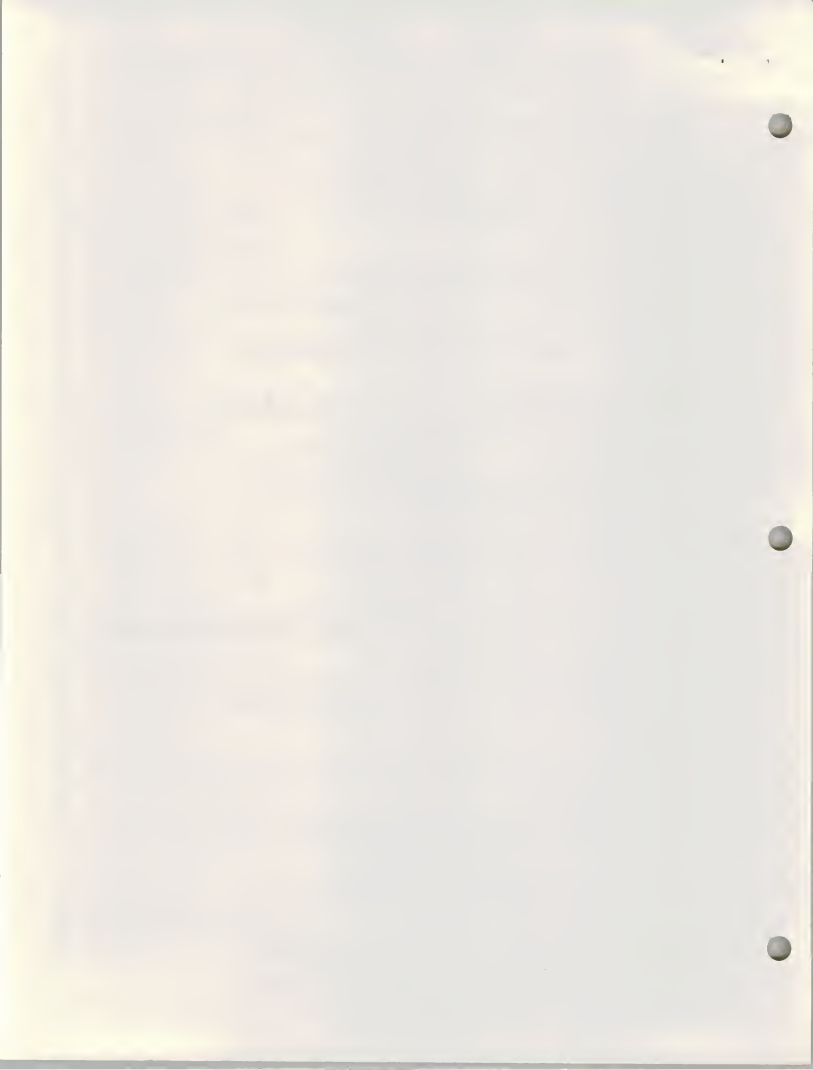
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* 90-06	Cable Guard Rail Change this Drawing No. to 90-20



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Except Drawing No. Changed to 90-20
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Added Effective 7-1-69
Revised Effective 1-1-71



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1-1-71

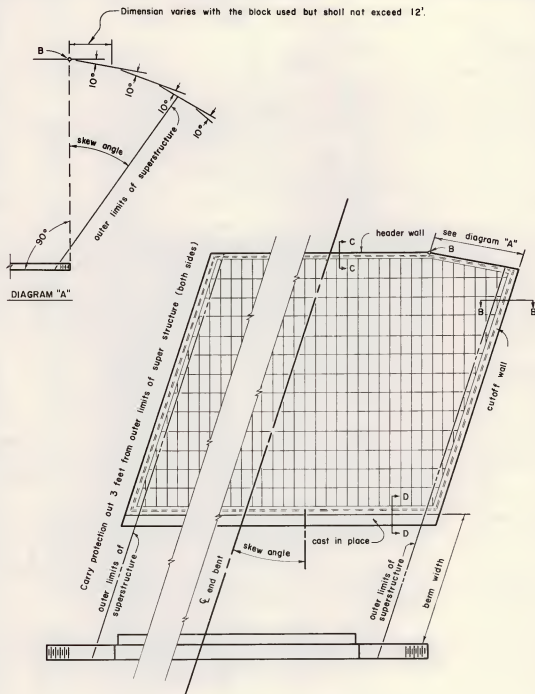
STANDARD DRAWING NO. 50-20-A

STATE HIGHWAY COMMISSION
HELENA, MONTANA

CONCRETE SLOPE PROTECTION (SEE 50-20 B & C)

APPROVED

STATE HIGHWAY ENGINEER



SKewed BRIDGE

NOTE:

Odd sections may be precast or cast in place at the contractors option.

Drawings not to scale



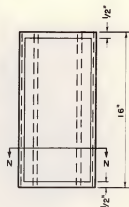
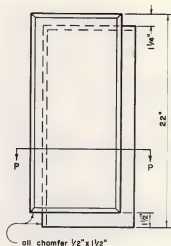
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STANDARD DRAWING NO. 50-20-B

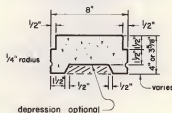
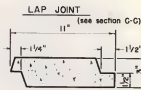
STATE HIGHWAY COMMISSION
HELENA, MONTANA

CONCRETE SLOPE PROTECTION (SEE 50-20 A & C)

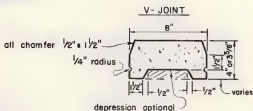
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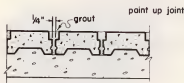
RECTANGULAR JOINT



SECTION P-P



SECTION N-N



Typical placement of the rectangular & V-joint

NOTES

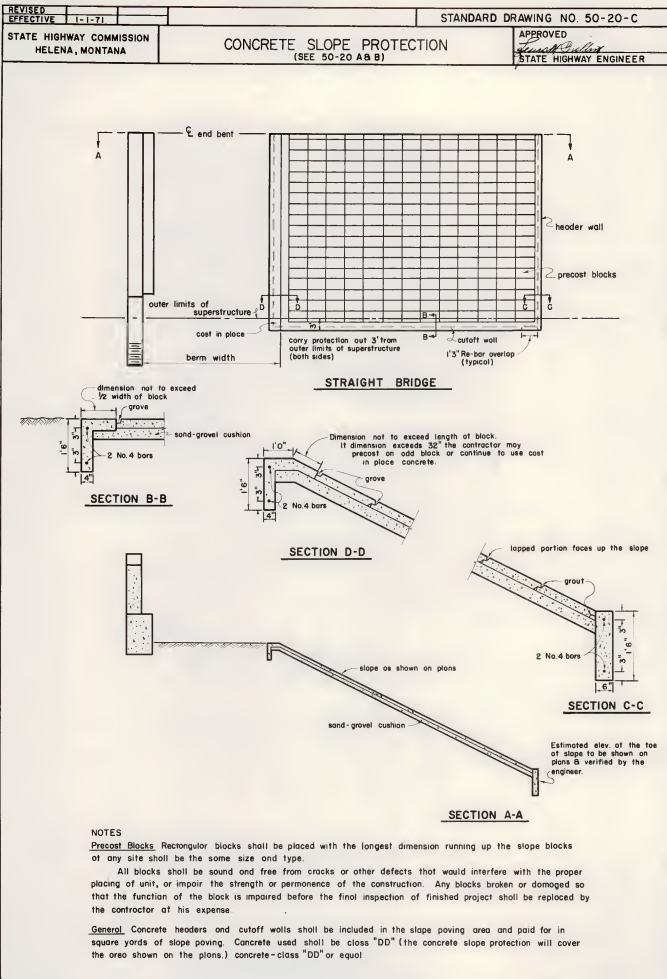
Size of Precast Blocks. The contract may choose the type and size of blocks may be $11'' \times 22''$, $22'' \times 44''$, or $44'' \times 66''$. Rectangular or V-joint blocks may be $8'' \times 16''$, $16'' \times 32''$, $32'' \times 48''$

Placement of Slope Protection. The concrete slope protection shall be placed after the structure has been finished and backfill around the structure is in place.

Embankment Preparation. The embankment slope shall be cleared of all brush, debris, and rubble. When a cushion is used the embankment slope shall be leveled to a reasonably uniform slope. Where no cushion is used, level to the slope indicated on the bridge plans. All loose material shall be compacted to the satisfaction of the engineer. A minimum of four inch sand-gravel cushion and leveling course shall be placed on the prepared embankment slope. Adjacent slope area shall be left in a smooth, uniform condition.

Interrupted Block Pattern. The area around bents or where the regular block pattern is interrupted shall be constructed with cast-in-place concrete and shall be marked into sections with an approved grover to match the pattern of the surrounding blocks. An approved one-half inch expansion joint filler material shall be used where the blocks or cast-in-place concrete abutts against any part of the structure.





NOTES

Precast Blocks Rectangular blocks shall be placed with the longest dimension running up the slope blocks of any site shall be the same size and type.

All blocks shall be sound and free from cracks or other defects that would interfere with the proper placing of unit, or impair the strength or permanence of the construction. Any blocks broken or damaged so that the function of the block is impaired before the final inspection of finished project shall be replaced by the contractor at his expense.

General Concrete headers and cutoff walls shall be included in the slope paving area and paid for in square yards of slope paving. Concrete used shall be class "DD" (the concrete slope protection will cover the area shown on the plans.) concrete-class "DD" or equal.



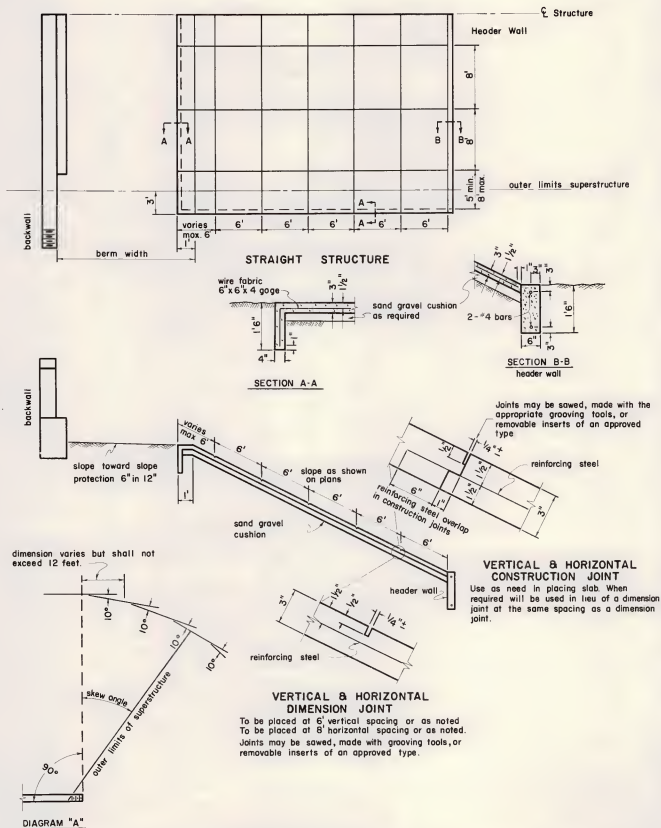
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STANDARD DRAWING NO. 50-21-A

STATE HIGHWAY COMMISSION
HELENA, MONTANA

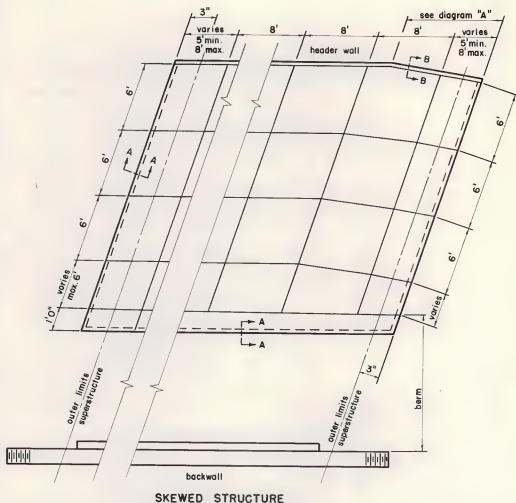
CONCRETE SLOPE PROTECTION
ALTERNATE II (SEE 50-21 B)

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REVISED EFFECTIVE	1-1-71		STANDARD DRAWING NO. 50-21-B
STATE HIGHWAY COMMISSION HELENA, MONTANA		CONCRETE SLOPE PROTECTION ALTERNATE II (SEE 50-21 A)	APPROVED <i>James M. Butler</i> STATE HIGHWAY ENGINEER



NOTE:
For additional notes see Standard Drawing No. 50-02

CAST IN PLACE CONCRETE

Locate joints as indicated on the plans. If construction is stopped for over two hours a construction joint shall be made. Payment shall be the same as for concrete blocks. Class "DD" concrete shall be used for all cast-in-place concrete.

An approved one half inch expansion joint filler shall be used wherever the cast in place concrete abuts against any part of the bridge structure concrete - class "DD" or equal.

REINFORCING STEEL

(may use either alternate listed below)

1. 3 bars at 0'10" centers (horiz. & vert spacing)
min. cover of 1 inch.
2. Welded wire fabric 6"x6"x4 gage

Six inch lap required at construction joints for reinforcing steel.



REVISED	7-9-68	10-25-68	11-16-70
EFFECTIVE	11-1-68	1-1-69	1-1-71

STANDARD DRAWING NO. 54-01

State Highway Commission
Helena, Montana

R.C.P. CULVERT BEDDING

Approved
John E. Pappas
State Highway Engineer

DESCRIPTION OF BEDDING CLASSES

CLASS A CONCRETE CHADLE BEDDING. THE LOWER PART OF THE PIPE EXTERIOR CHADLE CONSTRUCTED OF 2000 POUND CONCRETE OR BETTER, HAVING A MINIMUM THICKNESS UNDER THE PIPE OF ONE-FOURTH THE NORMAL INSIDE DIAMETER AND EXTENDING UNDER THE TOP OF THE PIPE FOR A HEIGHT EQUAL TO ONE-FOURTH THE INSIDE DIAMETER. THE UPPER PART OF THE CHADLE SHALL BE CONSTRUCTED MONOLITHICALLY WITHOUT HORIZONTAL CONSTRUCTION JOINTS.

CLASS B BEDDING. (1) THIS CLASS OF BEDDING FOR EMBANKMENT CONDITION IS SPECIALLY DESIGNED TO PROTECT THE PRODUCTION RATIO IS NOT GREATER THAN 0.7. THE PIPE SHALL BE CARBON STEEL OR GALVANIZED STEEL LATERALS OVER AN EARTH FOUNDATION, ACCURATELY SHAPED BY MEANS OF A TEMPLATE TO FIT THE LOWER PART OF THE PIPE EXTERIOR FOR AT LEAST 10% OF THE CULVERT OVERALL HEIGHT. COMPACTABLE SOIL MATERIAL SHALL THEN BE RAMPED AND TAMPED IN LAYERS NOT MORE THAN 6" THICK, AROUND THE PIPE TO THE TOP OF THE PIPE. THE TOP JOINT OF THE HEIGHT, BACKFILLING TO THE TOP OF THE PIPE SHALL CONFORM WITH THE APPLICABLE PROVISIONS OF THE STANDARD SPECIFICATIONS.

(2) FOR TRENCH CONDITIONS, THE CULVERT IS PLACED AS DESCRIBED IN B(1) EXCEPT THAT THE EARTH FOUNDATION NEEDS TO BE SHAPED TO FIT THE LOWER PART OF THE CULVERT EXTERIOR FOR A WIDTH OF AT LEAST 60% OF THE CULVERT EXTERIOR DIAMETER. THE TOP JOINT OF THE CULVERT SHALL BE SUBMERGED TO A HEIGHT OF AT LEAST 12" ABOVE ITS TOP BY OTHERWISE MATERIAL PLACED BY HAND TO FILL ALL SPACES UNDER AND ADJACENT TO THE CULVERT. TOP FILL IS TAMPED THOROUGHLY ON EACH SIDE AND UNDER THE CULVERT AS FAR AS PRACTICABLE IN LAYERS NOT TO EXCEED 6" IN THICKNESS.

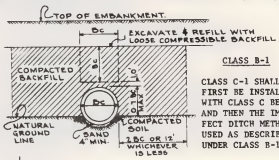
CLASS B-1 BEDDING. IN THIS TYPE OF INSTALLATION, SOMETIMES CALLED THE IMPERFECT TRENCH METHOD, THE PIPE CULVERT SHALL BE FIRST INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF B(1). THEN THE FILL SHALL BE COMPACTED AT EACH SIDE OF THE PIPE FOR A LATERAL DISTANCE EQUAL TO TWICE THE OUTSIDE DIAMETER OR 12" WHICH DIAMETER OF THE PIPE SHALL BE 12" TO 18".

THE TRENCH SHALL BE DUG IN WIDTH TO THE OUTSIDE DIAMETER OF THE PIPE SHALL BE DUG IN THE FILL DIRECTLY OVER THE CULVERT, DOWN TO AN ELEVATION 12" ABOVE THE TOP OF THE PIPE. CARE SHALL BE EXERCISED TO KEEP THE SIDES AS VERTICAL AS POSSIBLE. AFTER THE TRENCH IS EXCAVATED, IT SHALL BE BACKFILLED WITH THE SAME SOIL MATERIAL. THE SOIL MATERIAL, STUMP, HAY, LEAVES OR SAWDUST MAY BE USED TO INSURE HIGH COMPRESSIBILITY OF ONE-THIRD OF THE BACKFILL IN ORDER TO INSURE HIGH COMPRESSIBILITY OF THIS BACKFILL. THE BACKFILL OF STRAW, HAY, ETC. SHALL NOT BE CARRIED CLOSER THAN 10" TO THE OUTSIDE SLOPE OF THE FILL; THE OUTSIDE 10" SHALL BE COMPOSED OF IMPERVIOUS MATERIAL, THOROUGHLY COMPACTED. AFTER THE BACKFILL IS COMPLETED, THE BALANCE OF THE FILL SHALL BE CONSTRUCTED BY NORMAL METHODS UP TO THE FINISHED GRADE OF EMBANKMENT.

CLASS C BEDDING. FOR PROJECTING EMBANKMENT CULVERT, THIS METHOD OF BEDDING IS RECOMMENDED WITH "ORDINARY" CARE IN AN EARTH FOUNDATION SHAPED TO FIT THE LOWER PART OF THE CULVERT EXTERIOR WITH AT LEAST 10% OF ITS OVERALL HEIGHT (FOR AT LEAST 50% OF THE CULVERT EXTERIOR DIAMETER). THE REMAINDER OF PIPE SHALL BE SUBMERGED BY MATERIAL PLACED BY HAND TOOLS TO FILL COMPLETELY ALL SPACES UNDER AND ADJACENT TO THE PIPE. BACKFILLING TO THE TOP SHALL THEN BE COMPLETED AS SPECIFIED IN THE STANDARD SPECIFICATIONS.

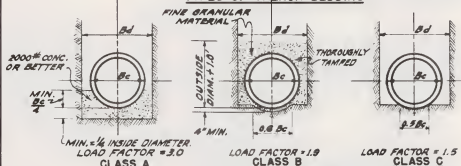
IF THE CULVERT IS PLACED ON ROCK FOUNDATIONS, PROJECTING EMBANKMENT CULVERT PIPES ARE BEDDED ON AN EARTH CUSHION HAVING A MINIMUM ALLOWABLE THICKNESS OF 12" AND WITH THE EARTH FOUNDATION CAREFULLY SHAPED AND FILLED AROUND THE CULVERT THE SAME AS ORDINARY PROJECTING EMBANKMENT BEDDING ON AN EARTH FOUNDATION.

CLASS C-1 BEDDING. THE PIPE SHALL BE INSTALLED IN ACCORDANCE WITH CLASS C BEDDING. THE IMPERFECT TRENCH METHOD SHALL THEN BE USED AS DESCRIBED UNDER CLASS B-1 BEDDING.

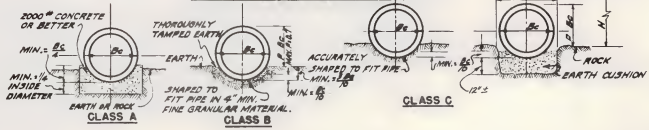


CLASS B-1
CLASS C-1 SHALL FIRST BE INSTALLED WITH CLASS C BEDDING, AND THEN THE IMPERFECT DITCH METHOD USED AS DESCRIBED UNDER CLASS B-1.

TYPES OF TRENCH BEDDING



TYPES OF EMBANKMENT BEDDING



WHEN NATURAL GROUND MATERIAL SIMULATES BEDDING MATERIAL, NO SPECIAL BEDDING MATERIAL NEED BE USED. USE CLASS "C" UNLESS OTHERWISE NOTED ON PLANS.

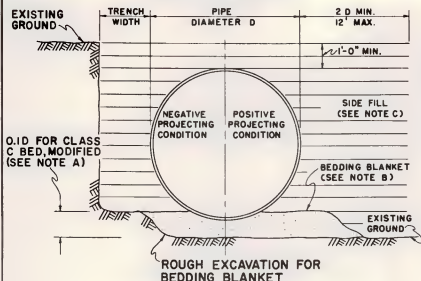


STATE HIGHWAY COMMISSION
HELENA, MONTANA

C.S.P. & S.S.P.P. CULVERT BEDDING

APPROVED
Frank R. Smith
STATE HIGHWAY ENGINEER

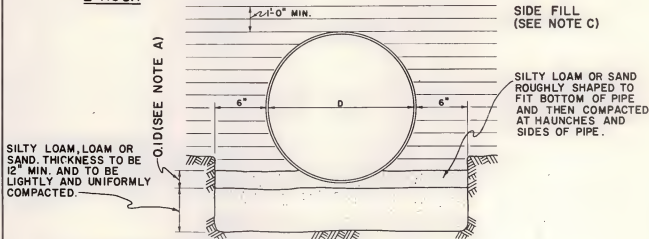
I-PIPE INSTALLATION AND BEDDING (CLASS C, MODIFIED)



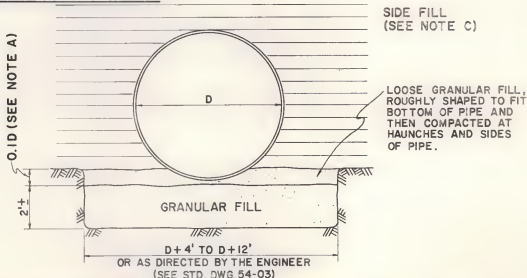
NOTES

- (A) FOR STRUCTURAL PLATE PIPE, THE LENGTH OF BEDDING ARC NEED NOT EXCEED WIDTH OF BOTTOM PLATE.
- (B) BEDDING BLANKET OF SILTY LOAM OR SAND, ROUGHLY SHAPED TO FIT BOTTOM OF PIPE, MINIMUM THICKNESS BEFORE PLACING PIPE IS 3".
- (C) SIDE FILL TO BE COMPACTED IN 6" LAYERS TO DENSITY SPECIFIED FOR ADJACENT EMBANKMENT. SEE ARTICLE 11.05 OF STANDARD SPECS. FOR THE DENSITY REQUIREMENTS.

2-ROCK



3-FOUNDATION STABILIZATION





REVISED				STANDARD DRAWING NO. 56-01
EFFECTIVE	1-1-71			APPROVED <i>Edward H. Miller</i>
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR C.S.P., H-20 LOADING $2\frac{2}{3} \times \frac{1}{2}$ " CORRUGATIONS		STATE HIGHWAY ENGINEER
HELENA, MONTANA				

FOR CORRUGATED STEEL PIPE, 2 $\frac{2}{3}$ -INCH BY $\frac{1}{2}$ -INCH CORRUGATIONS, RIVETED
WELDED, OR HELICAL FABRICATION, H-20 LOADING.

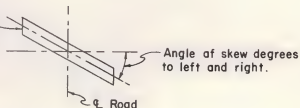
PIPE DIAMETER IN INCHES	MINIMUM COVER, TOP OF PIPE TO TOP OF SUBGRADE (INCHES)	AREA IN SQUARE FEET	MAXIMUM FILL HEIGHTS ABOVE TOP OF PIPE IN FEET				
			METAL THICKNESS IN INCHES				
			0.064	0.079	0.109	0.138	0.168
12	12	0.8	84	91			
15	12	1.2	67	73			
18	12	1.8	56	61			
24	12	3.1	42	46	59		
30	12	4.9	34	36	47		
36	12	7.1	28	30	39	41	
42	12	9.6	31	43	46(67)	48(70)	50(73)
48	12	12.6	27	37	45(58)	46(61)	47(64)
54	12	15.9		33	43(52)	44(54)	45(57)
60	12	19.6			43(47)	43(49)	44(51)
66	12	23.8			42	43	43(47)
72	12	28.3				41	43
78	12	33.2					39
84	12	38.5					35

NOTES: VALUES FOR ELONGATED PIPE ARE SHOWN IN PARENTHESIS. USE SPECIAL DESIGN
FOR STRUCTURES WITH HEIGHTS OF COVER EXCEEDING THESE TABLES.

SEE STD. DWG. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

Cut end of culvert
parallel to ϵ of
road when specified.



NOTE: When skew angle exceeds 20° and the
pipe arch has the ends cut to fit a
slope, ends shall be reinforced with
masonry.



REVISED				STANDARD DRAWING NO. 56-U2
EFFECTIVE	1-1-71			
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR C.S.P., H-20		APPROVED
HELENA, MONTANA		LOADING, 3"x1" CORRUGATIONS		STATE HIGHWAY ENGINEER

FOR CORRUGATED STEEL PIPE, 3-INCH BY 1-INCH CORRUGATIONS, RIVETED, WELDED, HELICAL, OR BOLTED FABRICATION, H-20 LOADING.

PIPE DIAMETER IN INCHES	MINIMUM COVER, TOP OF PIPE TO TOP OF SUBGRADE (INCHES)	AREA IN SQUARE FEET	MAXIMUM FILL HEIGHTS ABOVE TOP OF PIPE IN FEET				
			METAL THICKNESS IN INCHES				
			0.064	0.079	0.109	0.138	0.168
36	12	7	48	60	78(88)	89(106)	101(118)
42	12	10	41	51	64(76)	71(91)	79(101)
48	12	13	36	45	57(66)	61(80)	66(88)
54	12	16	32	40	52(59)	55(71)	59(79)
60	12	20	29	36	49(53)	51(64)	54(71)
66	12	24	26	33	47	49(58)	51(64)
72	12	28	24	30	44	47(53)	49(59)
78	12	33	22	28	41	46(49)	47(54)
84	12	38	21	26	38	45	46(51)
90	12	44	19	24	35	43	45
96	12	50	18	22	33	40	44
102	24	57	17	21	31	38	42
108	24	64		20	30	35	39
114	24	71		19	28	34	37
120	24	78			27	32	35

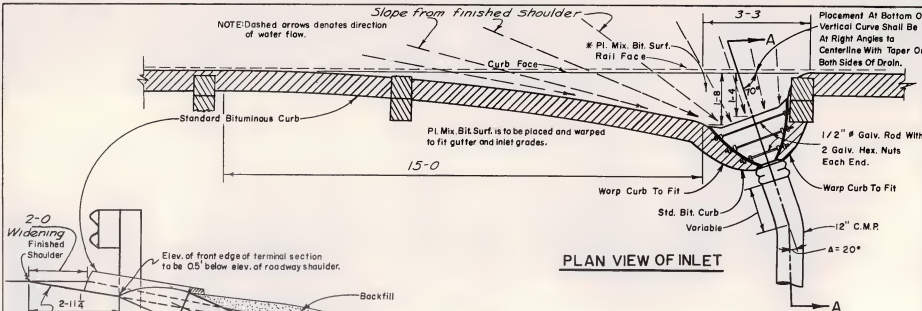
NOTES: VALUES FOR ELONGATED PIPE ARE SHOWN IN PARENTHESIS. USE SPECIAL DESIGN FOR STRUCTURES WITH HEIGHTS OF COVER EXCEEDING THESE TABLES.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

GALVANIZED STEEL THICKNESS AND GAGES

ZINC COATED STEEL THICKNESS IN INCHES	GAGE NO. FOR INFORMATIONAL PURPOSES ONLY
0.064	16
0.079	14
0.109	12
0.188	10
0.168	8
0.168	7
0.218	5
0.249	3
0.280	1





PLAN VIEW OF INLET

SECTION A-A

GENERAL NOTES

Conduit May Be Either Circumferential Or Helical.

Θ And A Shall Be As Shown Unless Otherwise Specified In The Plans Or By The Engineer.

Contractor Shall Not Order Pipe Until Directed By The Engineer.

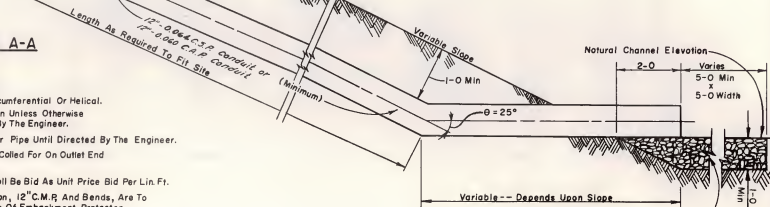
Flared End Section May Be Called For On Outlet End When Specified On Plans.

Embankment Protector Shall Be Bid As Unit Price Bid Per Lin. Ft.

The 12" Flared End Section, 12" C.M.P. And Bends, Are To Be Included In Total Length Of Embankment Protector.

All Other Hardware Shall Be Included In The Unit Price Bid Per Lin. Ft. Of Embankment Protector.

* Included With Roadway Quantities.



Approx. 1 1/2 Cu. Yd. Type 3 Bank Protection -- To Be Placed In Manner Best Suited To Fit Existing Conditions.

OUTLET DETAIL



REVISED			STANDARD DRAWING NO. 57-00
EFFECTIVE	1-1-71		
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR C.S.P. ARCH	APPROVED
HELENA, MONTANA		3"x1" CORRUGATIONS	<i>James M. Chilton</i> STATE HIGHWAY ENGINEER

CORRUGATED STEEL PIPE ARCHES, 3-INCH BY 1-INCH CORRUGATIONS, RIVETED, WELDED, OR HELICAL FABRICATION, H-20 LOADING.

PIPE DIMENSIONS SPAN X RISE (INCHES)	AREA (SQ. FT.)	CORNER RADIUS INCHES	MINIMUM COVER INCHES	MINIMUM THICKNESS REQUIRED (INCHES)	MAXIMUM FILL HEIGHTS (FEET)
					CORNER BEARING PRESSURE 2-TONS / SQ. FT.
43 X 27	6.4	7 3/4	18	0.064	12
50 X 31	8.7	9	18	0.064	12
58 X 36	11.4	10 1/2	18	0.064	12
65 X 40	14.3	12	18	0.064	12
72 X 44	17.6	13 1/4	18	0.064	12
73 X 55	21.3	18	18	0.064	15+
81 X 59	25.3	18	18	0.079	15
87 X 63	31.0	18	18	0.079	14
95 X 67	35.0	18	18	0.109	13
103 X 71	40.0	18	24	0.109	12
112 X 75	46.0	18	24	0.109	11
117 X 79	52.0	18	24	0.109	10
128 X 83	58.0	18	24	0.138	9

NOTES: WHERE BEARING PRESSURES EXCEEDING 2 TONS PER SQUARE FOOT ARE REQUIRED FOR GIVEN FILL HEIGHT, THE FOUNDATION MATERIAL SHALL BE INVESTIGATED TO DETERMINE ITS BEARING CAPACITY.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

SEE STD. DWG. NO. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.



REVISED			STANDARD DRAWING NO. 57-01
EFFECTIVE	1-1-71		APPROVED
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR C.S.P. ARCH	<i>James H. Patton</i>
HELENA, MONTANA		2 2/3" X 1/2" CORRUGATIONS	STATE HIGHWAY ENGINEER

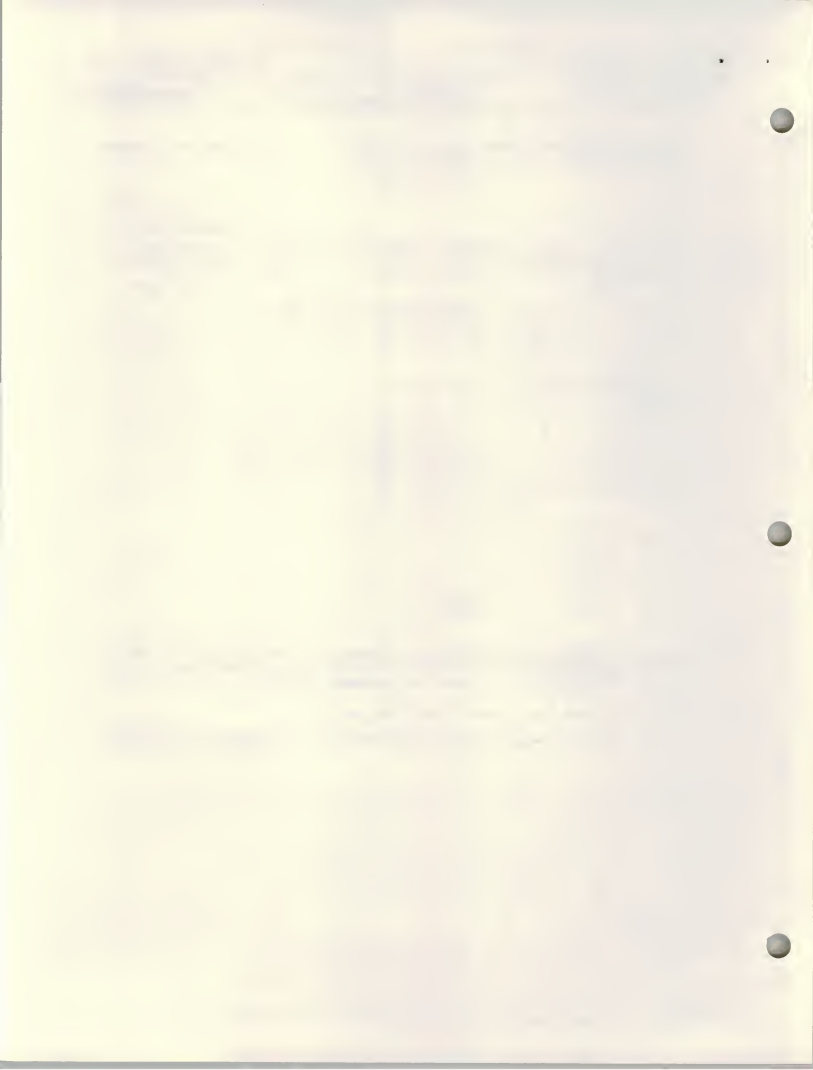
FOR CORRUGATED STEEL PIPE ARCHES, 2 2/3-INCH BY 1/2 INCH CORRUGATIONS, RIVETED, WELDED, OR HELICAL FABRICATION, H-20 LOADING.

PIPE DIMENSIONS SPAN X RISE (INCHES)	AREA (SQ. FT.)	CORNER RADIUS (INCHES)	MINIMUM COVER (INCHES)	MINIMUM THICKNESS REQUIRED (INCHES)	MAXIMUM FILL HEIGHTS (FEET)
					CORNER BEARING PRESSURE 2 TONS / SQ. FT.
18X11	1.1	3 1/2	18	0.064	13
22X13	1.6	4	18	0.064	12
25X16	2.2	4	18	0.064	10
29X18	2.8	4 1/2	18	0.064	10
36X22	4.4	5	18	0.064	9
43X27	6.4	5 1/2	18	0.064	9
50X31	8.7	6	18	0.079	8
58X36	11.4	7	18	0.109	8
65X40	14.3	8	18	0.109	8
72X44	17.6	9	18	0.138	8
79X49	21.3	10	18	0.168	8
85X54	25.3	11	18	0.168	9

NOTES: WHERE BEARING PRESSURES EXCEEDING 2 TONS PER SQUARE FOOT ARE REQUIRED FOR GIVEN FULL HEIGHT, THE FOUNDATION MATERIAL SHALL BE INVESTIGATED TO DETERMINE ITS BEARING CAPACITY.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

SEE STD. DWG. NO. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.



REVISED				STANDARD DRAWING NO. 59-00
EFFECTIVE	1-1-71			
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR C.S.P. H-20 LOADING 6"x2" CORRUGATIONS		APPROVED <i>[Signature]</i> STATE HIGHWAY ENGINEER
HELENA, MONTANA				

FOR CORRUGATED STEEL PIPE, 6-INCH BY 2-INCH CORRUGATIONS, BOLTED FABRICATION, H-20 LOADING.

PIPE DIAMETER IN INCHES	MINIMUM COVER TOP OF PIPE TO TOP OF SUBGRADE (INCHES)	MAXIMUM FILL HEIGHTS ABOVE TOP OF PIPE IN FEET						
		METAL THICKNESS IN INCHES						
		0.109	0.138	0.168	0.188	0.218	0.249	0.280
120	12	43	62	81	93	106(111)	116(132)	126(144)
72	12	36	52	68	73(78)	79(93)	85(110)	91(120)
84	12	31	44	58	61(67)	65(79)	69(94)	72(103)
96	12	27	39	51	55(58)	57(69)	60(82)	62(90)
108	24	24	34	45	50	52(62)	54(73)	56(80)
120	24	22	31	41	47	49(56)	50(66)	52(72)
132	24	20	28	37	42	47(51)	48(60)	49(66)
144	24	18	26	34	39	45	46(55)	47(60)
156	24	17	24	31	36	43	45(50)	46(56)
168	24	15	22	29	33	40	44(47)	45(52)
180	24	14	21	27	31	37	44	44(48)
192	24		19	25	29	35	41	43
204	36		18	24	27	33	39	43
216	36			23	26	31	37	40
228	36			21	25	29	35	38
240	36				23	28	33	36
252	36					27	31	34

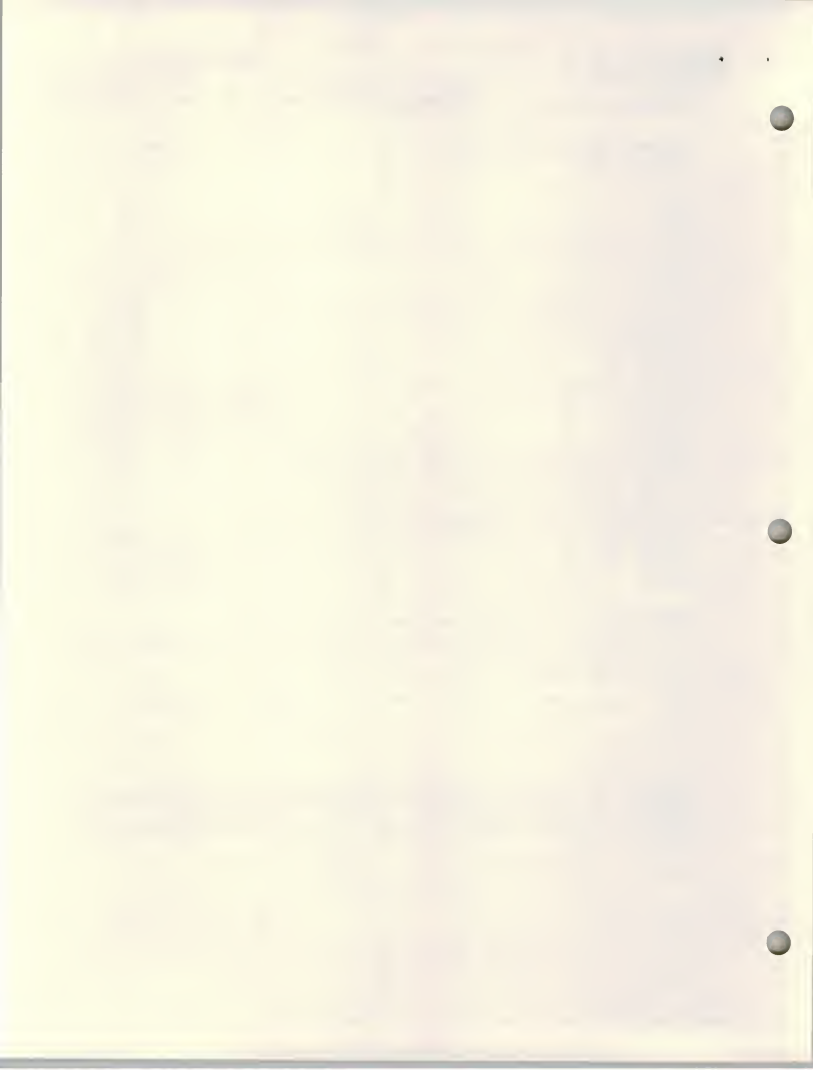
NOTES: VALUES FOR ELONGATED PIPE ARE SHOWN IN PARENTHESIS.

USE SPECIAL DESIGN FOR STRUCTURES WITH HEIGHTS OF COVER EXCEEDING THESE TABLES.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

SEE STD. DWG. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.

PIPE DIAMETER (INCHES)	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	252
AREA (SQ. FT.)	19.6	28.3	38.5	50.3	63.6	78.5	95.0	113.1	132.7	153.9	176.7	201.1	227.0	254.5	283.5	314.2	346.4



REVISED				STANDARD DRAWING NO. 59-01
EFFECTIVE	1-1-71			
STATE HIGHWAY COMMISSION		FILL HEIGHT FOR C.S.P. ARCH		APPROVED
HELENA, MONTANA		6"X2" CORRUGATIONS		<i>[Signature]</i> STATE HIGHWAY ENGINEER

FOR CORRUGATED STEEL PIPE ARCHES, 6-INCH BY 2-INCH CORRUGATIONS, BOLTED, FABRICATION, H-20 LOADING.

PIPE DIMENSIONS SPAN X RISE (FT.-IN.)	AREA (SQ. FT.)	CORNER RADIUS (INCHES)	MINIMUM COVER (INCHES)	MINIMUM THICKNESS REQUIRED (INCHES)	MAXIMUM FILL HEIGHTS (FEET) CORNER BEARING PRESSURE 2 TONS / SQ. FT.
6'-1" X 4'-7"	22	18	18	0.109	15
7'-0" X 5'-1"	28	18	18	0.109	15
7'-11" X 5'-7"	35	18	18	0.109	12
8'-10" X 6'-1"	43	18	24	0.109	11
9'-9" X 6'-7"	52	18	24	0.109	10
10'-11" X 7'-1"	61	18	24	0.109	9
11'-10" X 7'-7"	71	18	24	0.109	8
12'-10" X 8'-4"	85	18	24	0.109	8
13'-3" X 9'-4"	98	31	24	0.109	13
14'-2" X 9'-10"	110	31	24	0.109	12
15'-4" X 10'-4"	124	31	24	0.138	11
16'-3" X 10'-10"	138	31	36	0.138	11
17'-2" X 11'-4"	153	31	36	0.138	11
18'-1" X 11'-10"	168	31	36	0.168	9
19'-3" X 12'-4"	185	31	36	0.168	9
19'-11" X 12'-10"	202	31	36	0.168	8
20'-7" X 13'-2"	214	31	36	0.188	8

NOTES: WHERE BEARING PRESSURES EXCEEDING 2 TONS PER SQUARE FOOT ARE REQUIRED FOR GIVEN FILL HEIGHT, THE FOUNDATION MATERIAL SHALL BE INVESTIGATED TO DETERMINE ITS BEARING CAPACITY.

IF SKEW IS REQUIRED SEE STD. DWG. NO. 56-01.

SEE STD. DWG. NO. 56-02 FOR GALVANIZED STEEL THICKNESS AND GAGE TABLE.



REVISED	9-1-66	11-22-68	9-1-70	
EFFECTIVE	9-1-66	1-1-69	1-1-71	

STANDARD DRAWING NO. 81-01

State Highway Commission
Helena, Montana

WIRE FENCE - INTERSTATE TYPE

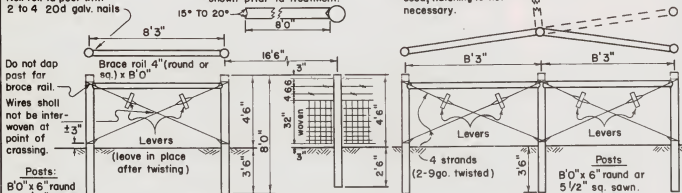
Approved
[Signature]
State Highway Engineer

See Std. Dwg. No. 81-02

Noil roil ta post with
2 to 4 20d galv. nails

Brace rail to be natched as shown prior to treatment.

When square posts are used, notching is not necessary.



or 5 1/2" sq. sown.

SINGLE PANEL

Far pulling, stretching, changes in vertical alignment or panels on a run of less than 330'

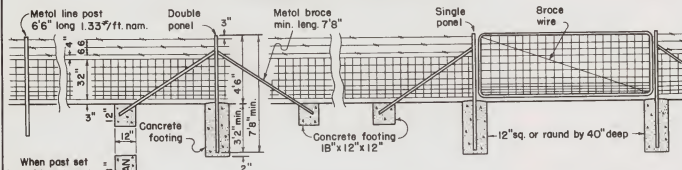
LINE POST

4" Min. round or
4"x4" std. sq.

DOUBLE PANEL

Far corners, pulling or stretching, and changes in horizontal alignment.

TYPE "CW"- "STRAIGHT RUN" FENCE WITH WOOD POSTS



When past set
in solid rock, cut
to provide 18" min.
burial

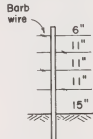
STEEL GATE & BRACING

TYPE "CM" - FENCE WITH STEEL POSTS



"M" indicates metal post.
"W" indicates wood post.
Braces, corners, deadman
and other features some
as "GW" and "GM" fence.

Wire stay halfway between
pasts.
44" on "CB5"
42" on "CB4"



TYPE "CB4" & "CB5" WIRE FENCE

NOTES:

All fence wire to be placed on pasture side of past except curves, the wire shall be placed on the outside of the curve. In areas subject to high velocity winds and moving debris, wires may all be placed on windward side of pasts. Except on curves.

All concrete shall be class "F" or better.

Maximum bow in wood posts -- 2" in 7'

Post spacing measured generally parallel to ground

Line past shall normally be spaced 16'6" apart. Also 16'6" from brace or panel pasts.

24" wire stoy to be placed halfway between posts, excepting panels on "CM" and "CW" fence.

Fence with wooden posts to have one metal post, in place of a wooden line post, in each 500' run for lighting protection.

Type "CW" panels (wood) will be used on type "CM" fence instead of steel panels when so specified.

Steel carner, end, gote and pull past and each brace shall be set in concrete as shown.

"Terminal Post" shall be at the end of any run of wire or of any stretch panel.

A deadman may be a precast concrete block, a cast in place concrete block, a rock or other approved object—weighing at least 150 lbs.—and covered at least 2 feet.

Staple the bottom, top, center and alternote wires of waven wire to wood line posts.

Staple all wires of woven wire to wood corner posts or post used to tie-off wire.

Maximum run between panels see STD. DWG. 81-02.



State Highway Commission
Helena, Montana

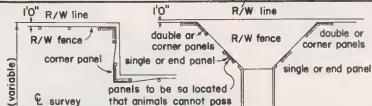
WIRE FENCE - INTERSTATE TYPE

Approved
James H. Dyer
State Highway Engineer



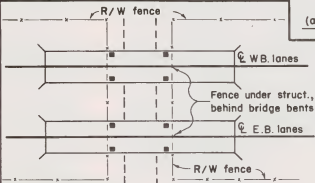
FENCE CONNECTION TO CATTLE GUARD

For detail of cattle guard see standard drawing
Wire fence shall be securely fastened to the wings
and so arranged that animals cannot pass.

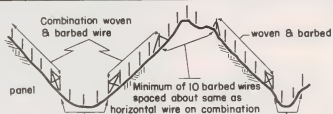


PLAN OF FENCE
(at change in R/W width)

LAYOUT OF CROSS-FENCE CONNECTION

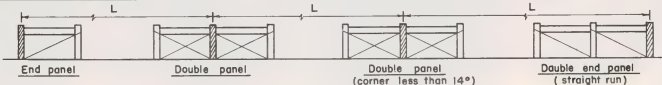


PLAN OF FENCE
(local road under interstate)

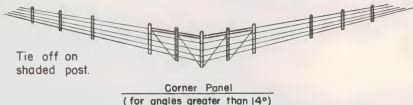
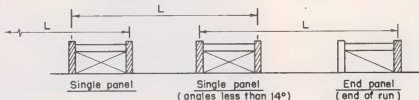


FENCE CONSTRUCTION ON SHARP VERTICAL CURVES

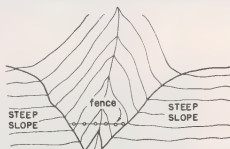
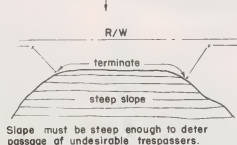
To avoid trying to conform woven wire to uneven terrain.

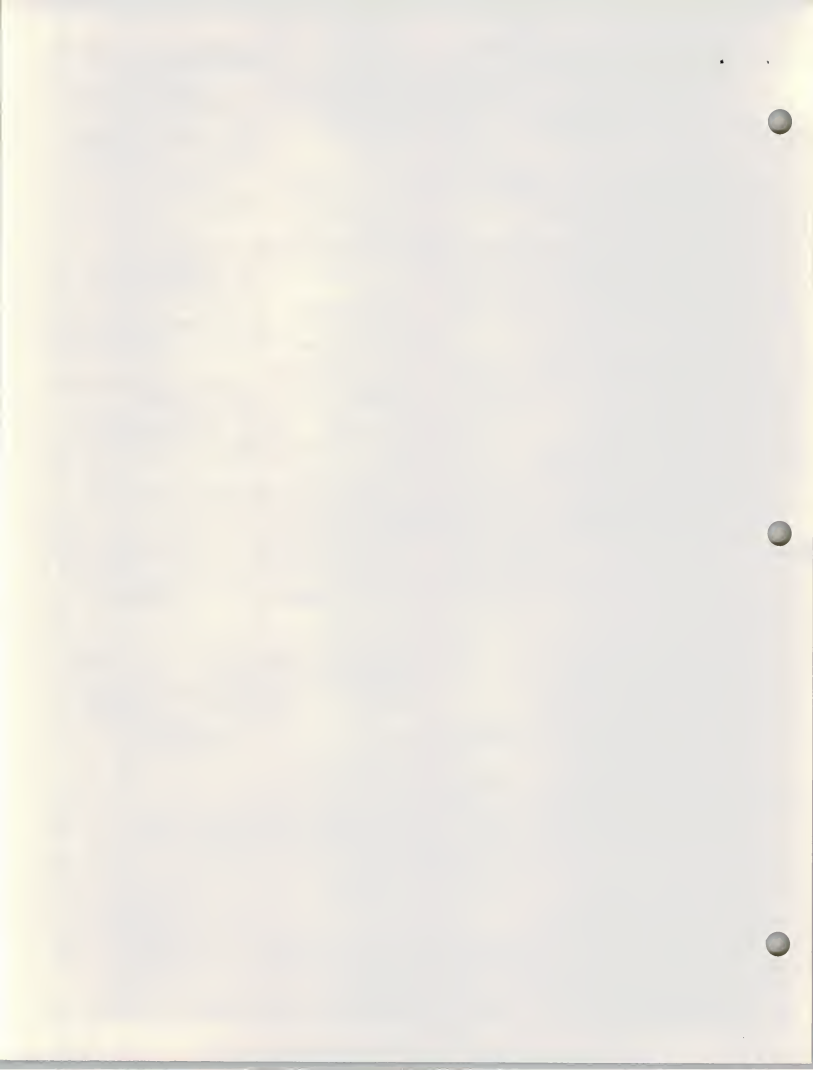


Fence type	run = L	panels required
Woven	33' or less	none
	33' - 330'	single or end
	over 330'	double
	max. 660'	
Barbed	66' or less	none
	66' - 660'	single or end
	over 660'	double
	max. 990'	



PERMISSIBLE FENCE LAYOUTS WHERE STEEP BACKSLOPES OR BANKS EXIST





REVISED 12-1-70
EFFECTIVE 1-1-71

STANDARD DRAWING NO. 81-03

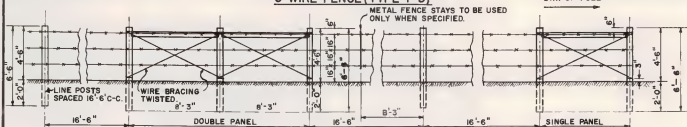
State Highway Commission
Helena, Montana

FARM FENCE

Approved

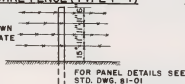
Chief Engineer 12-24-68
State Highway Engineer

3 WIRE FENCE (TYPE F-3)

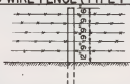


4 WIRE FENCE (TYPE F-4)

ALL WIRE
SPACING SHOWN
IS APPROXIMATE



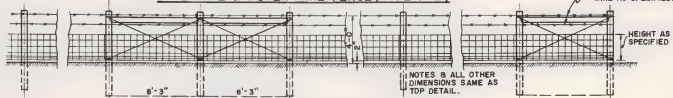
5 WIRE FENCE (TYPE F-5)



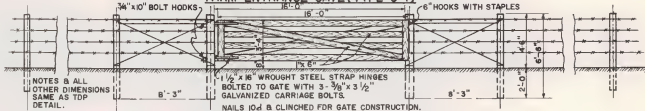
6 WIRE FENCE (TYPE F-6)



BARB WIRE & WOVEN WIRE FENCE (TYPE F-2)

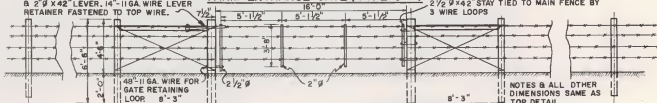


FARM ENTRANCE GATE (TYPE G-1)

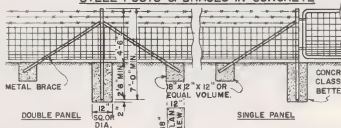


46" NO. 2 ELECTRICALLY WELDED TWIST
LINK CHAIN SECURELY STAPLED TO POST
8" 2" X 42" LEVER, 14" 1/4" WIRE LEVER
RETAINER FASTENED TO TOP WIRE.

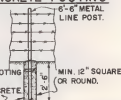
FARM ENTRANCE GATE (TYPE G-2)



STEEL POSTS & BRACES IN CONCRETE



METAL POST CONCRETE FOOTING



METAL LINE POSTS

6'-6" LONG, 1.33 LBS. PER FT.,
NOMINAL FACTORY PAINTED OR
GALVANIZED.

CORNER, GATE & END POSTS

7'-0" LONG (NOMINAL)

TERMINAL POST

SHALL BE AT THE END OF ANY RUN OF
WIRE OR AT ANY STRETCH PANEL.

TYPE G-3 GATE
IS METAL.

A GOOD SUBSTANTIAL
GATE, COMMERCIALY
AVAILABLE AND IN
GENERAL USE.

NOTE:

A DEAD MAN MAY BE A CONCRETE BLOCK, A
CAST-IN-PLACE CONCRETE BLOCK, A ROCK
OR OTHER APPROVED OBJECT, WEIGHING AT
LEAST 150 LBS., AND COVERED AT LEAST 2 FEET

NOTE: (STEEL POSTS)

EACH CORNER, END GATE, OR PULL POST
AND EACH BRACE SHALL BE SET IN CONCRETE
AND BRACED AS INDICATED.

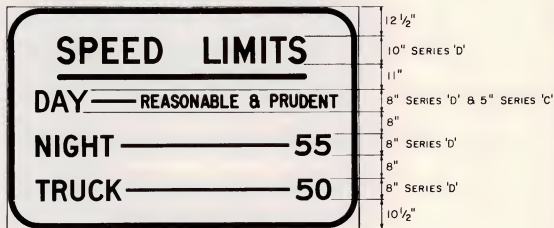
USE A 16" GATE UNLESS R/W AGREEMENT STATES
OTHERWISE.

ON TYPE G-2 FARM GATE, MATERIAL SHALL BE
THE SAME AS NEW FENCE.



Drawn 3-1-63	REVISED	9-16-64	9-1-70		STANDARD DRAWING NO. 88-07
	EFFECTIVE	9-16-64	1-1-71		
State Highway Commission Helena, Montana		STANDARD R2-12 SIGN			Approved <i>[Signature]</i> State Highway Engineer

R2-12, BLACK LEGEND ON
A WHITE REFLECTORIZED BACKGROUND



R2-12
132" X 84"

NOTE:
CENTER 1 1/2" BAR BETWEEN LINES 1 & 2
DASHES IN LINES 2, 3, & 4 ARE 1" WIDE.
THE MARGIN IS 1/2" AND THE BORDER IS 2".
THE CORNER RADIUS IS 12".



Drwn 3-1-66

Revised 11-1-68 11-28-69 11-1-70
Effective 1-1-69 1-1-70 1-1-71

STANDARD DRAWING NO. 88-09

State Highway Commission
Helena, Montana

SIGNING OF MEDIAN U-TURNS

Approved
State Highway Engineer

R3-10
36 x 48



Margin = $\frac{5}{8}$ "
Border = $\frac{7}{8}$ "
Corner Radius = 2"

6"
4" SERIES 'C'
4"
4" SERIES 'C'
4"
4" SERIES 'C'
4"
4" SERIES 'C'
4"
4" SERIES 'C'
6"

R3-4



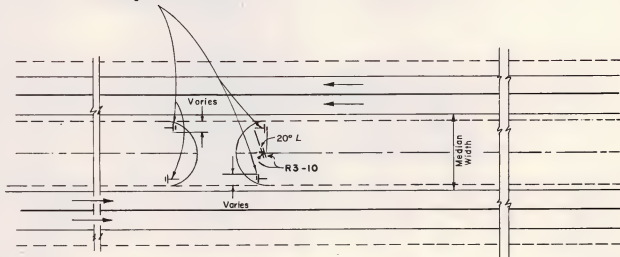
6"
8" Series D
4"
12" Series F
4"
8" Series D
6"

Note:

R3-4 and R3-10 Shall have black legend on White reflectorized background.

For median widths of 76 feet or less, R3-10 Signs shall be mounted back to back. They shall be placed at the centerline of the median and on the side of the U-turn away from the nearest interchange. Median widths greater than 76 feet will require separate installations on either side of the U-turn at specified clearance. For openings through median guard rails, the sign post shall be placed in line with guard rail post.

Design 'B' delineator as specified in Standard Drawing No. 88-91

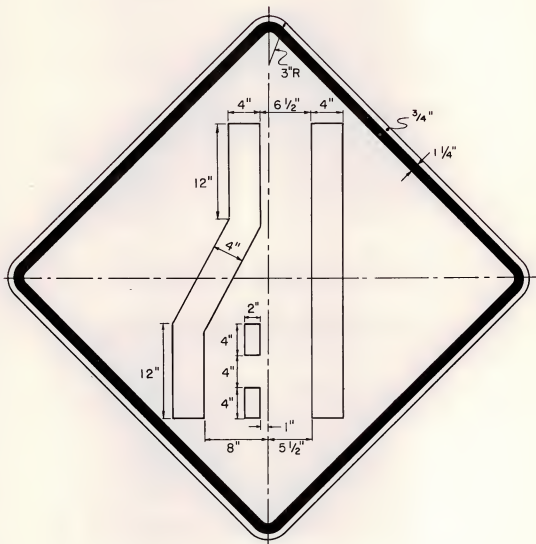


U-TURN MEDIAN OPENINGS
(See Std. Dwg. 11-03)



Drawn 3-1-63	REVISED	9-1-70	STANDARD DRAWING NO. 88-16
State Highway Commission Helena, Montana	EFFECTIVE 3-1-63	1-1-71	Approved <i>James H. Stoddard</i> State Highway Engineer

STANDARD W4-2 WARNING SIGN



W4-2
48" X 48"

BLACK ON REFLECTORIZED YELLOW



Drawn 6-19-68

Revised
Effective9-1-70
1-1-71

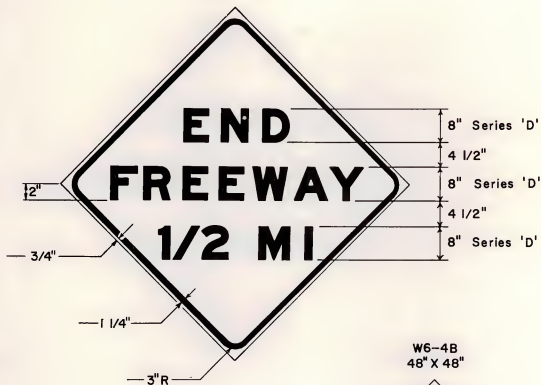
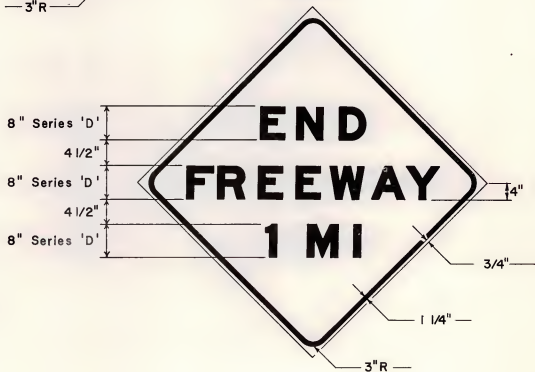
STANDARD DRAWING NO. 88-18

State Highway Commission
Helena, Montana

W6-4A & W6-4B

Approved

State Highway Engineer

W6-4A
48" X 48"W6-4B
48" X 48"



Drawn 3-1-66	REVISED EFFECTIVE 3-1-66	9-1-70 1-1-71	STANDARD DRAWING NO. 88-19
State Highway Commission Helena, Montana		W8-9, W9-2, W9-5, & W9-6 WARNING SIGNS	
		Approved State Highway Engineer	



5" Series D

5" Series D

W8-9
30 X 30

NOTE

Warning sign W8-9 shall have black legend and borders on a reflectorized yellow background. The Bureau of Public Roads "STANDARD ALPHABET" shall be used.



4" Series D

4" Series D

4" Series D

W9-5
30 X 30

NOTE

Warning signs W9-2, W9-5, & W9-6 shall have black legend and borders on a yellow background. The Bureau of Public Roads "STANDARD ALPHABET" shall be used.



5" Series B

5" Series B

5" Series B

W9-6
30 X 30



5" Series C

5" Series C

W9-2
30 X 30



Drawn 9-1-64

Revised 3-1-67 9-1-70
Effective 6-1-67 1-1-71

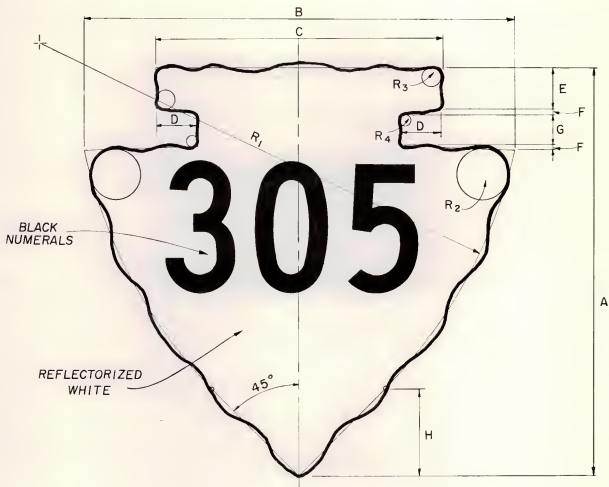
STANDARD DRAWING NO. 86-28

State Highway Commission

Helena, Montana

SECONDARY ROUTE MARKER
FOR USE ON GUIDE SIGNS

Approved

James M. Sullivan
Act. State Highway Engineer

SHIELD DIMENSIONS IN INCHES

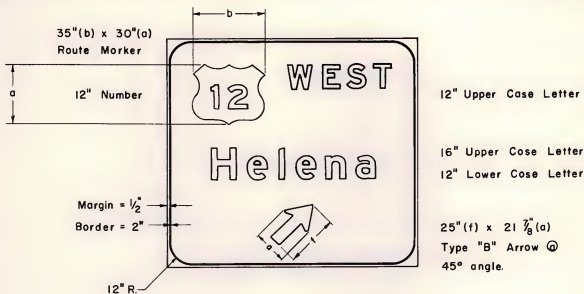
	NUMERAL SIZE	A	B	C	D	E	F	G	H	R ₁	R ₂	R ₃	R ₄
*	8" C	26	28	18 $\frac{1}{2}$	2 $\frac{5}{8}$	3	$\frac{5}{16}$	2	5 $\frac{1}{2}$	32	1 $\frac{3}{4}$	$\frac{5}{8}$	$\frac{5}{16}$
**	10" C	32	34	22 $\frac{1}{2}$	3 $\frac{1}{4}$	3 $\frac{5}{8}$	$\frac{3}{8}$	2 $\frac{1}{2}$	6 $\frac{3}{4}$	38 $\frac{1}{2}$	2	$\frac{3}{4}$	$\frac{3}{8}$
***	12" C	40	42	28	4	4 $\frac{1}{2}$	$\frac{1}{2}$	3	8 $\frac{7}{16}$	48	2 $\frac{1}{2}$	1	$\frac{1}{2}$

* TO BE USED WITH STANDARD 24" U. S. SHIELD

** TO BE USED WITH STANDARD 30" & 36" U. S. SHIELD

*** TO BE USED WITH STANDARD 42" U. S. SHIELD & ALL INDEPENDENT USE

208



Dimensions shown are typical only; see plans for actual sizes

SIGN DESIGN SPECIFICATIONS

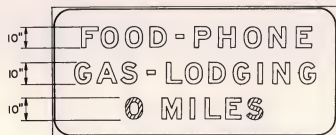
Smaller Dimension of Sign	Corner Radius
0'-0" TO 2'-6"	3"
3'-0" TO 4'-6"	6"
5'-0" TO 6'-6"	9"
7'-0" & Greater	12"

Largest Letter on Sign	Margin	Border
8" Letters or Less	$\frac{1}{2}$ "	1"
Greater Than 8"	$\frac{1}{2}$ "	2"

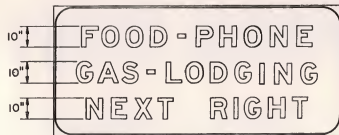
NOTES

- All Interstate and U.S. Route Markers, and all Arrows used on Guide Signs must conform to those shown in the AASHO "Manual for Signing and Pavement Markings", 1961 Interstate Edition.
- All State Route Markers must conform to those shown in Standard Drawings 88-27 & 88-28.
- Guide Signs shall have white legend and border on an Interstate Green background. Legend, border, and background shall be reflectorized.
- Series "E" Letters in Type "A" or "B" demountable legend shall be used unless otherwise specified. Legends eight inches or less may be either demountable or direct applied cutout letters.
- Signs to be overlaid shall have Type "C" direct applied cutout legend and border.

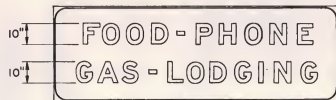




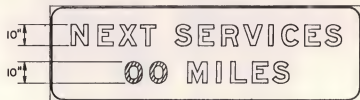
I-1
12'-0" X 5'-6"



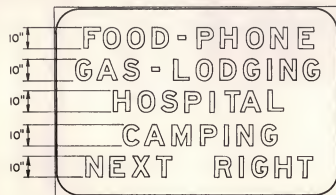
I-1a
12'-0" X 5'-6"



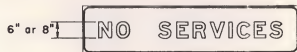
I-2
12'-0" X 4'-0"



I-6
13'-0" X 4'-0"



I-7
12'-0" X 8'-0"



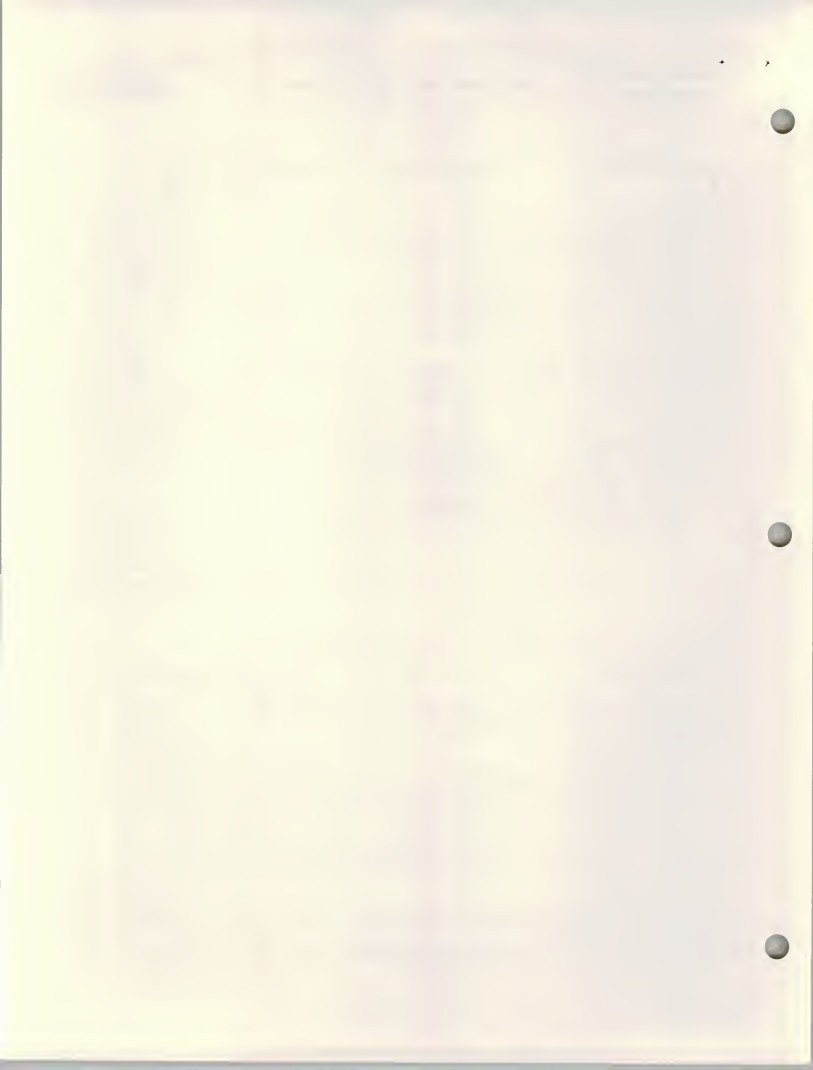
I-8
7'-0" X 1'-6" or 9'-0" X 2'-0"

NOTES:

I-1, I-1a & I-2; If any one of the services is not available the space it normally occupies is to be left blank. See plan sheets for services to be shown.

I-8; Legend size varies according to sign location.

Service guide signs shall have white legend and border on a Interstate Blue background. Legend, border and background shall be reflectorized. Type A or B removable copy shall be used. (See Standard Specifications)



Drawn _____

S.D. 16.2 9-1-70
C.E. 1-1-71

STANDARD DRAWING NO.

88-37A

State Highway Commission
Helena, Montana

INFORMATIONAL SIGNS - REST AREA

Approved

Frank C. Patton
State Highway EngineerI - 3
12'-0" x 5'-0"I - 4
12'-0" x 5'-0"21 7/8" x 25"
Type "B" Arrow at 45°I - 5
6'-6" x 6'-6"

NOTES:

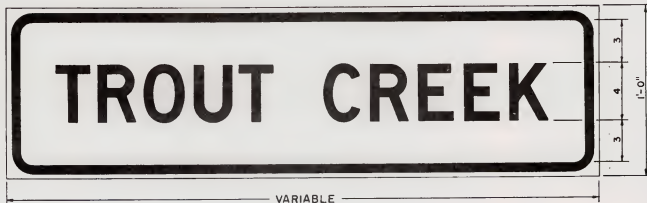
Informational guide signs shall have white legend and border on a Interstate Blue background. Legend, border and background shall be reflectarized. Type A or B removable copy shall be used. (See Standard Specifications)



Drawn Oct. 1, 1964

REVISED 9-1-70
EFFECTIVE 1-1-71

STANDARD DRAWING NO. 88-38

State Highway Commission
Helena, MontanaSTANDARD N6-2 STREAM NAME SIGN
PRIMARY & SECONDARY ROUTESApproved
[Signature]
State Highway Engineer

NOTES:

1. SIGN SIZE VARIES WITH LEGEND.
2. SIGNS OVER 36" WIDE SHALL HAVE 2" x 4" BACK BRACES.
3. SIGN FACE & LEGEND:
 - REFLECTORIZED GREEN BACKGROUND.
 - 4" SERIES 'D' REFLECTORIZED WHITE LETTERS.
 - 3/8" MARGIN.
 - 5/8" REFLECTORIZED WHITE BORDER.
 - 1 1/2" CORNER RADII.



Drawn 6-24-68

Revised

Effective

6-24-68 1-1-70

1-1-69 2-1-69 1-1-71

STANDARD DRAWING NO. 88-39

State Highway Commission

Helena, Montana

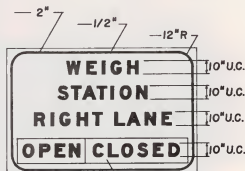
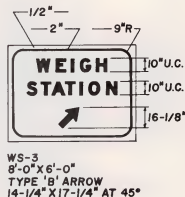
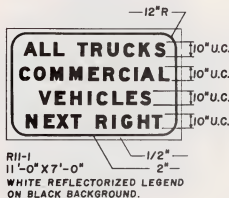
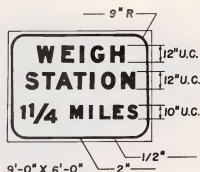
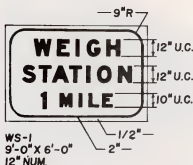
WEIGH STATION SIGNS

Approved

State Highway Engineer

NOTE

WEIGH STATION GUIDE SIGNS SHALL HAVE WHITE LEGEND AND BORDER ON INTERSTATE GREEN BACKGROUND. LEGEND, BORDER, AND BACKGROUND SHALL BE REFLECTORIZED. TYPE A, B REMOVABLE COPY SHALL BE USED. (SEE STANDARD SPECIFICATIONS).



To Be Designed By Electrical Dept.



State Highway Commission
Helena, Montana

STANDARD REST AREA & INFORMATION SIGNS

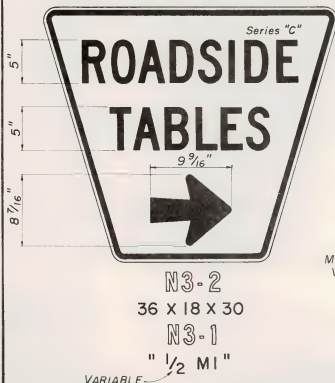
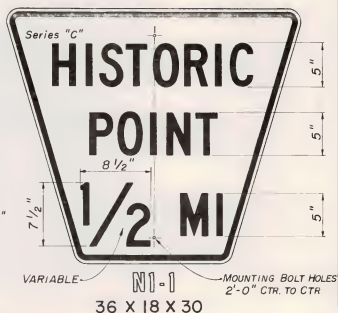
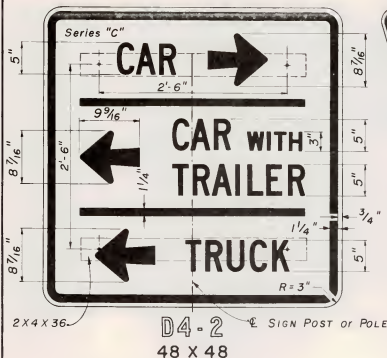
Approved
John M. Sullivan
State Highway Engineer

NOTES:

1. ALL SIGNS ON THIS PAGE SHALL HAVE GREEN LEGEND AND BORDERS ON A WHITE REFLECTORIZED BACKGROUND.
2. ALL DIRECTIONAL ARROWS SHALL BE THE INTER-STATE TYPE "B" ARROW, $9\frac{9}{16}$ " X $8\frac{7}{16}$ ".

3. SEE D4-2 & N7-1 FOR TYPICAL SIGN PANEL DETAILS. (BORDER, MARGIN, ETC.)

4. SIGNS ON THIS PAGE ARE TYPICAL SIGNS. SEE PLAN SHEETS FOR ACTUAL SIGN LAYOUTS.





Drawn 6-1-65

Revised 11-7-68 9-1-70
Effective 1-7-69 1-1-71

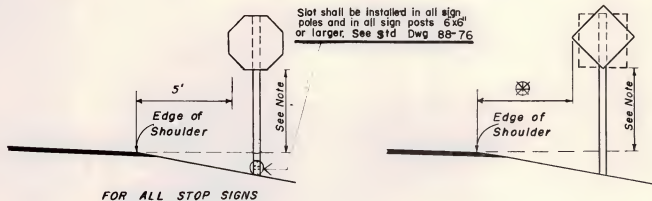
STANDARD DRAWING NO. 88-57

State Highway Commission
Helena, Montana

TYPICAL SIGN ERECTION

Approved
James A. Patton
State Highway Engineer

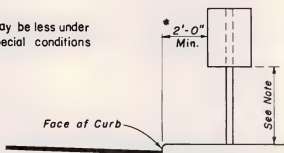
FOR REGULATORY & WARNING SIGNS



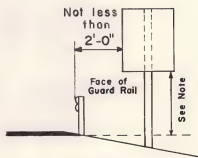
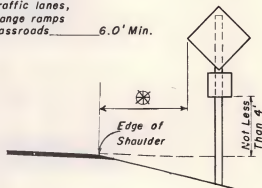
NOTE ÷ MOUNTING HEIGHTS

Rural _____ 5.0' Min.

Urban _____ 7.0' Min.

Roads with Four or more traffic lanes,
interchange ramps
and Crossroads _____ 6.0' Min.* May be less under
special conditions

FOR CURBED SECTION



FOR GUARD RAIL SECTION



NOTE:

SIGNS LESS THAN 10 SQ. FT. SHALL BE
MOUNTED 10' FROM SHOULDER EDGE.SIGNS GREATER THAN 10 SQ. FT. SHALL BE
MOUNTED 20' FROM SHOULDER EDGE.



State Highway Commission
Helena, Montana

TYPICAL CROSSROAD & RAMP LAYOUT

Approved
James H. Smith
State Highway Engineer

R5-4
36" x 24"

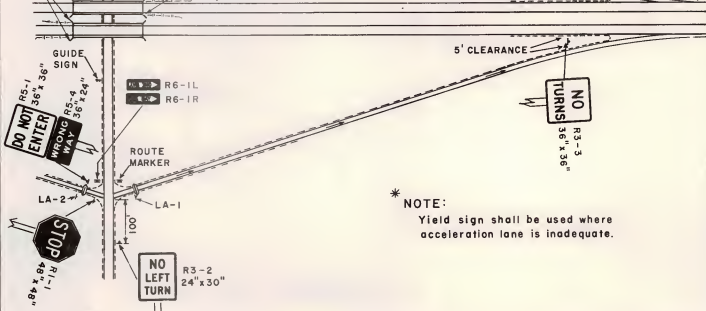
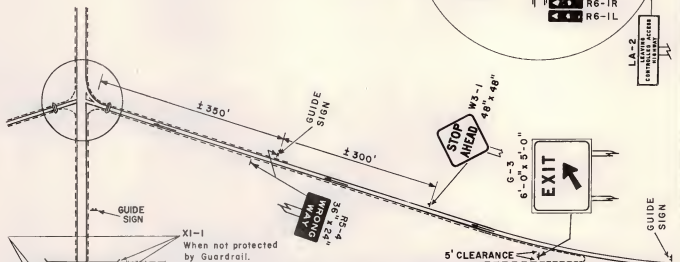
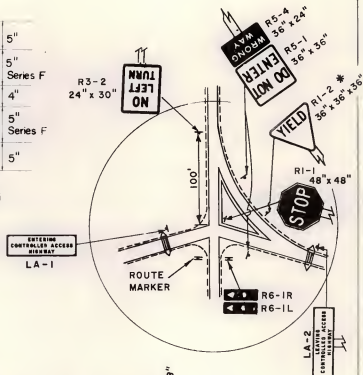


5/8" Border

2" Corner Radius

White legend on a red reflectorized background

5"
5" Series F
4"
5" Series F
5"



* NOTE:
Yield sign shall be used where
acceleration lane is inadequate.



State Highway Commission
Helena, Montana

STANDARD GUIDE SIGNS

Approved
[Signature]
State Highway Engineer

NOTE -
FOR DESIGN SPECIFICATIONS
SEE STANDARD DRAWING
NO 88-36

12" U. C.
SERIES E.

TYPE 'A' ARROW
29 1/4" x 18 1/4"
at 30° ANGLE



G-3
6'-0" x 5'-0"

4" TOP ϕ T.T. POLES

1 1/2" ϕ BREAK AWAY HOLES
SEE STD. DWG. 88-76

Edge of Shoulder
(Mainline)

Edge of Shoulder
(Ramp)

3'-0"



Drawn 6-1-65

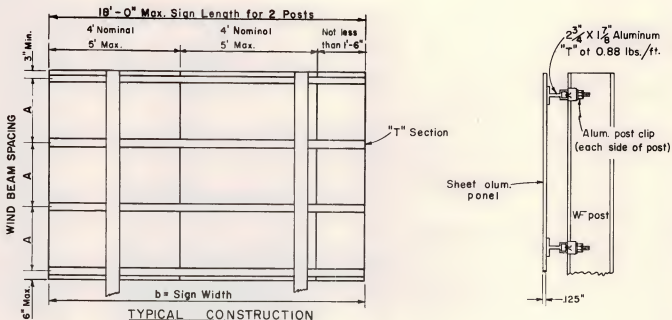
Revised 3-1-67 9-1-70
Effective 6-1-67 1-1-71

STANDARD DRAWING NO. 88-68

State Highway Commission
Helena, Montana

ALUMINUM SHEET INCREMENT GUIDE SIGNS

Approved
Samuel R. Smith
State Highway Engineer



NOTE:

Signs less than 4'-0" high and 8'-0" long will be made of a single sheet of aluminum.

Signs up to, and including, 8'-0" high will have no horizontal joints and no sheet shall be less than 1'-6" wide.

Signs over 8'-0" high may have horizontal and verticle joints, however no sheet shall be less than 1'-6" wide or 1'-6" high.

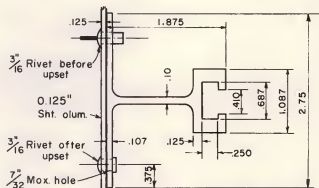
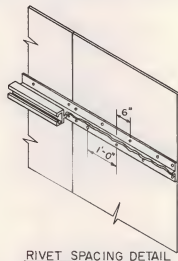
Tighten post clip nuts to 225 ⁱⁿ lbs torque using dry, clean threads.

No splices are allowed in extruded "T" sections.

All horizontal joints must occur at "T" sections.

All sheet aluminum shall be 0.125 thick.

Short width panels shall be placed on inside edge next to shoulder.



NOTE:

Rivets 6" apart staggered from one side to another on horizontal extruded frame section.

Rivets doubled (both sides of extruded frame) of horizontal and vertical joints in sheet aluminum face end of ends of extruded T-section.

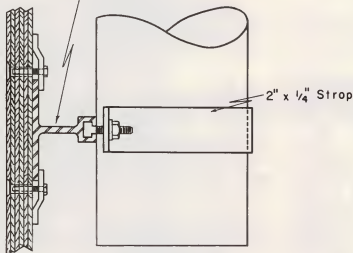
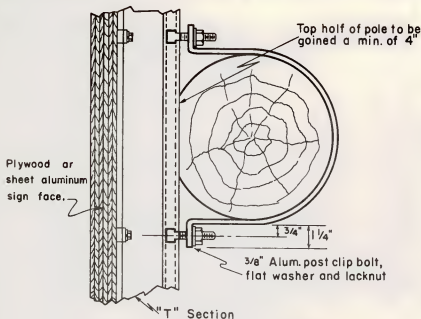
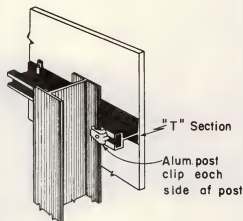
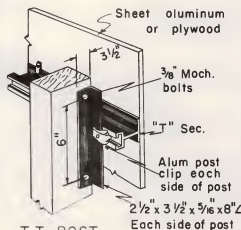
WIND BEAM CHART

WIND BEAM SPA, "A"	b MAX.		.20 b MAX.		.15 b MAX.		.60 b MAX.		.35 b MAX.	
	2 POST	3 POST	2 POST	3 POST	2 POST	3 POST	2 POST	3 POST	2 POST	3 POST
1-8	18-0	27-0	3-7	4-1	10-10	9-5				
1-10	17-0	25-8	3-5	3-10	10-2	9-0				
2-0 MAX.	16-6	24-6	3-4	3-8	9-10	8-7				



State Highway Commission
Helena, Montana

GUIDE SIGN MOUNTING DETAILS

Approved
James H. Butler
State Highway EngineerT.T. POLEW.F. POSTT.T. POSTNOTE:

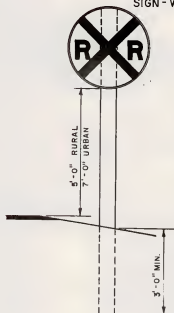
1. Mounting systems shown are typical. Other systems may be approved by the engineer.
2. All steel hardware shall be galvanized.



State Highway Commission
Helena, Montana

RAILROAD CROSSING SIGNS

Approved

James H. Phillips
State Highway EngineerADVANCE WARNING
SIGN - WIO-1

The Advance Warning Signs shall be the standard WIO-1 36" diameter sign shown in the Manual on Uniform Traffic Control Devices for Streets and Highways. It shall have black legend on a reflectorized yellow background. The sign shall be constructed of 6061-T6 aluminum sheet, 0.100 inch minimum thickness. Fabrication shall conform with the Standard Specifications.

The WIO-1 sign shall be erected with a 10 ft horizontal clearance from the edge of the shoulder or face of the curb. The mounting height to the bottom of the sign shall be 5 ft in rural areas and 7 ft in urban areas.

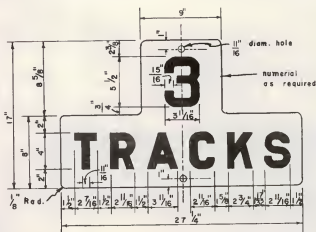
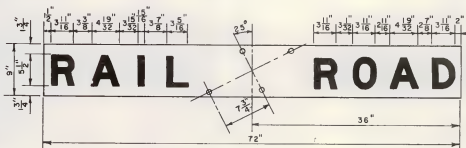
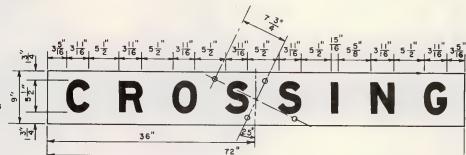
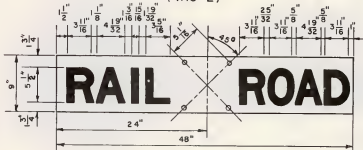
In rural areas a treated timber pole or post (break-away design) shall be used. See Std. Dwg. 88-76. In urban areas a 2 1/2" diameter pipe post using the breakaway device as shown on sign standard No. 10.

Bolts shall be 5/8" aluminum, galvanized steel or cadmium plated steel, lengths as required.

See Std. Dwg. No. 88-71



(WIO-2)





Drawn 3-1-63

REVISED 3-1-66 11-28-69 9-1-70
EFFECTIVE 3-1-66 7-1-70 1-1-71

STANDARD DRAWING NO. 88-74

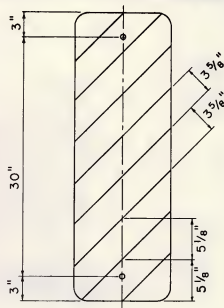
State Highway Commission
Helena, Montana

X-1-1 SIGN & ERECTION DETAIL

Approved

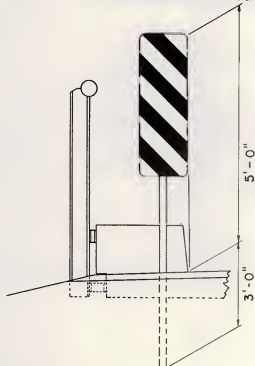
James H. Butler 11-2-68
State Highway Engineer

12" X 36"



NOTE:

STRIPES SHALL BE BLACK AND REFLECTORIZED WHITE.

PANELS SHALL BE MOUNTED ON GALVANIZED STEEL U-POSTS 2 LBS./FT.
WITH INSIDE EDGE FLUSH WITH FACE OF CURB.

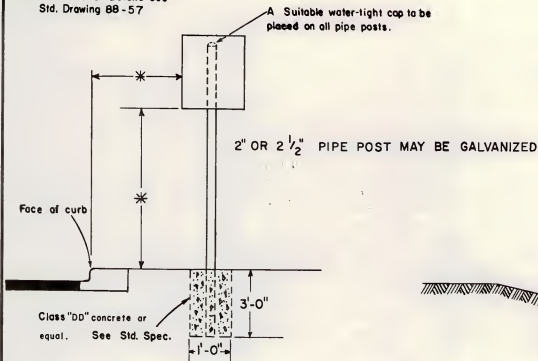


State Highway Commission
 Helena, Montana

TYPICAL PIPE POST MOUNTING DETAIL

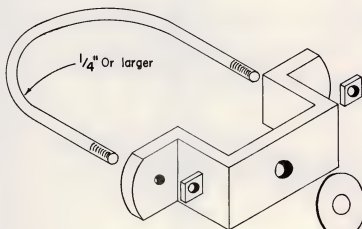
Approved
 State Highway Engineer

* For Erection Details see
 Std. Drawing 88-57

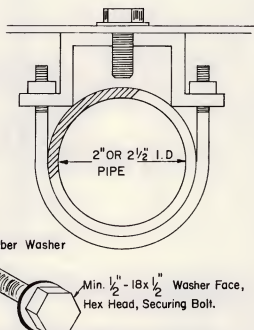


CURB MOUNTING

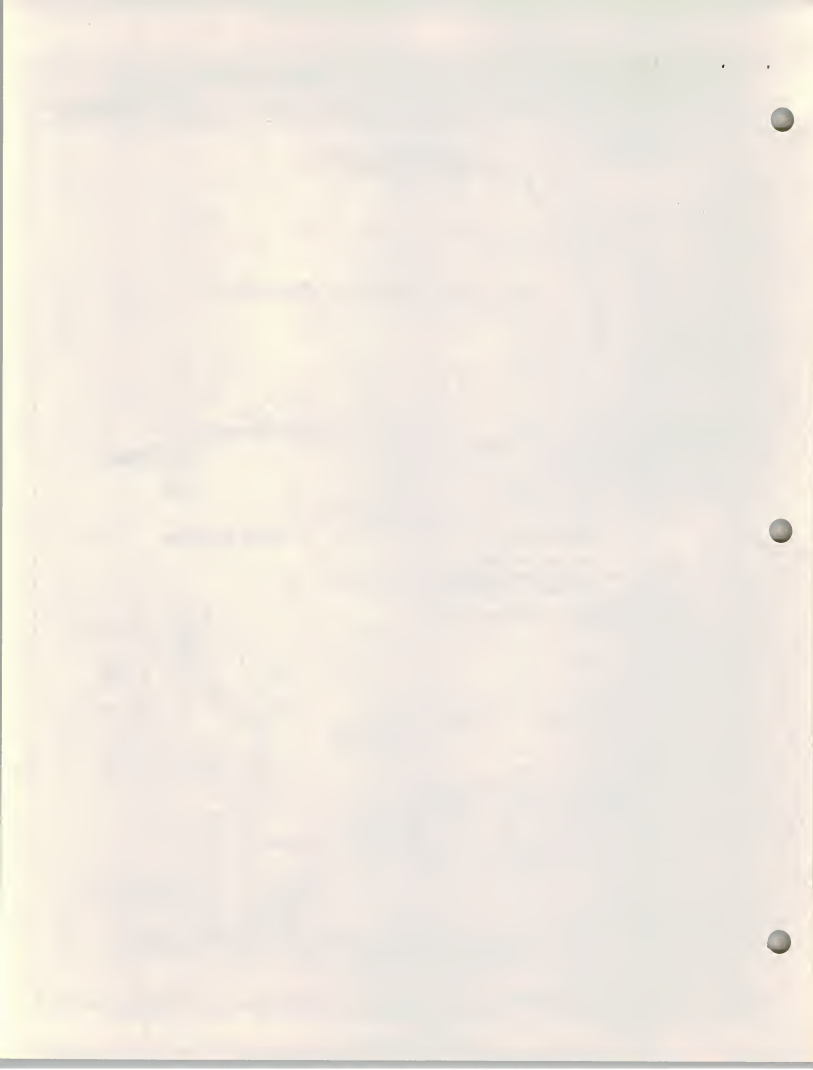
NOTE: For back to back sign installation, two "U" brackets will be required using two-
 2 1/2" x 1/4" carriage bolts in place of "U" bolt.
 All hardware shall be cadmium plated or galvanized.



SLOPE MOUNTING



TYPICAL "U" BRACKET FOR 2" OR 2 1/2" PIPE POST



Drawn 3-1-68

Revised 11-1-68 9-1-70
Effective 11-1-68 1-1-71

STANDARD DRAWING NO. 68-76

State Highway Commission
Helena, Montana

WOOD POLE SLOT DETAIL

Approved

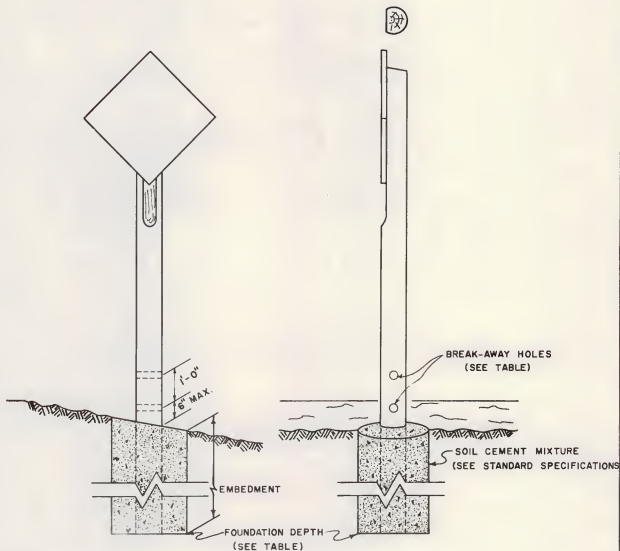
Louis M. Chilton
State Highway EngineerSTANDARD BREAK AWAY DETAIL
SINGLE OR MULTIPLE ROUND TIMBER POLES

TABLE OF DIAMETERS & FOUNDATIONS		
POLE SIZE	HOLE DIA.	EMBEDMENT
3" TOP Ø	—	3' - 0"
4" TOP Ø	1 1/2"	3' - 0"
5" TOP Ø	1 7/8"	3' - 6"
6" TOP Ø	2 1/8"	3' - 6"
CLASS 4	2 1/2"	4' - 0"
CLASS 3	2 5/8"	4' - 0"

NOTES:

ALL CUTTING, TRIMMING AND BORING
OF TREATED TIMBER POLES SHALL BE
IN ACCORDANCE WITH STANDARD SPECIFICATIONS.

TREATED TIMBER POSTS, 4"X 4" OR 4"X 6"
WILL NOT REQUIRE HOLES FOR BREAKAWAY DESIGN.



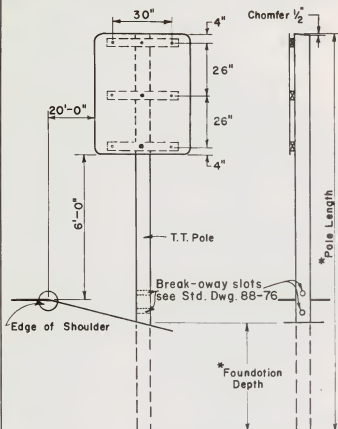
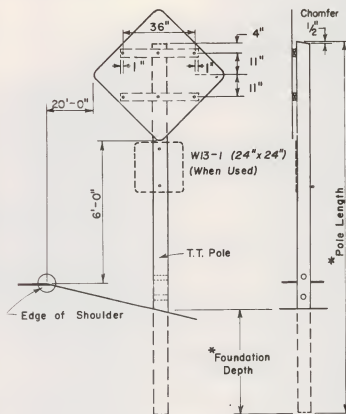
Drawn 3-1-66

Revised 11-1-68 9-1-70
Effective 1-1-69 1-1-71

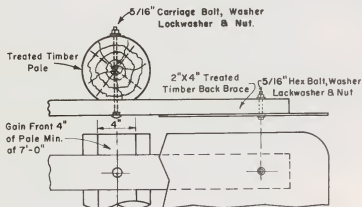
STANDARD DRAWING NO. 88-77

State Highway Commission
Helena, Montana

TYPICAL SIGN ERECTION

Approved
James J. Patton
State Highway EngineerTYPICAL ERECTION
48" x 60" REGULATORY SIGNTYPICAL ERECTION
48" x 48" WARNING SIGN

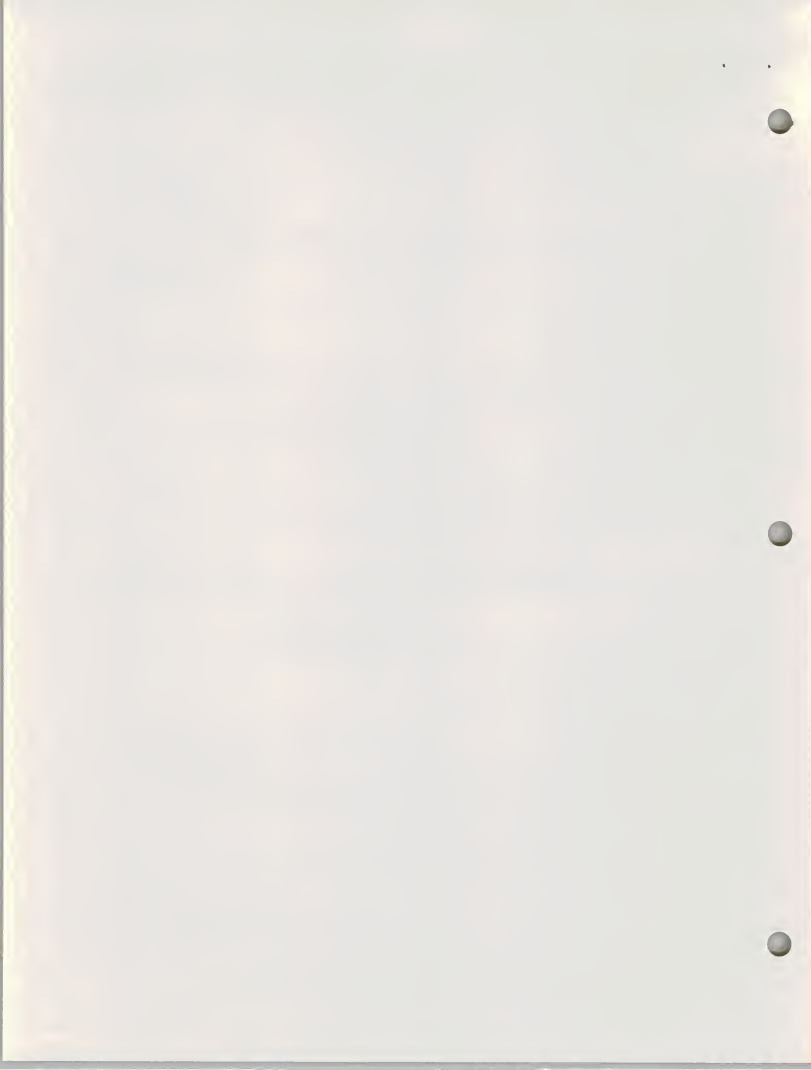
* For Pole Lengths and Foundation Depth-See Sign Plans "Sign Location and Erection" Sheet. For details see Std. Dwg. 88-76

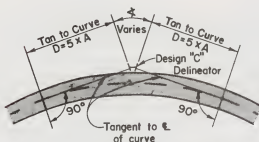


SIGN FASTENING AND BACK BRACE DETAILS

NOTE:

Signs greater than 10 sq. ft. shall be mounted 20' from shoulder edge. Caution should be taken to avoid placing signs in a position where it is not easily visible to the motorist.

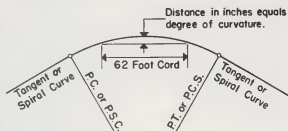




Place Design "C" Delineators on curves sharper than 7° 30'. Position delineator faces perpendicular to tangent to center line of curve as shown. Spacing shall be as called for in Table below.

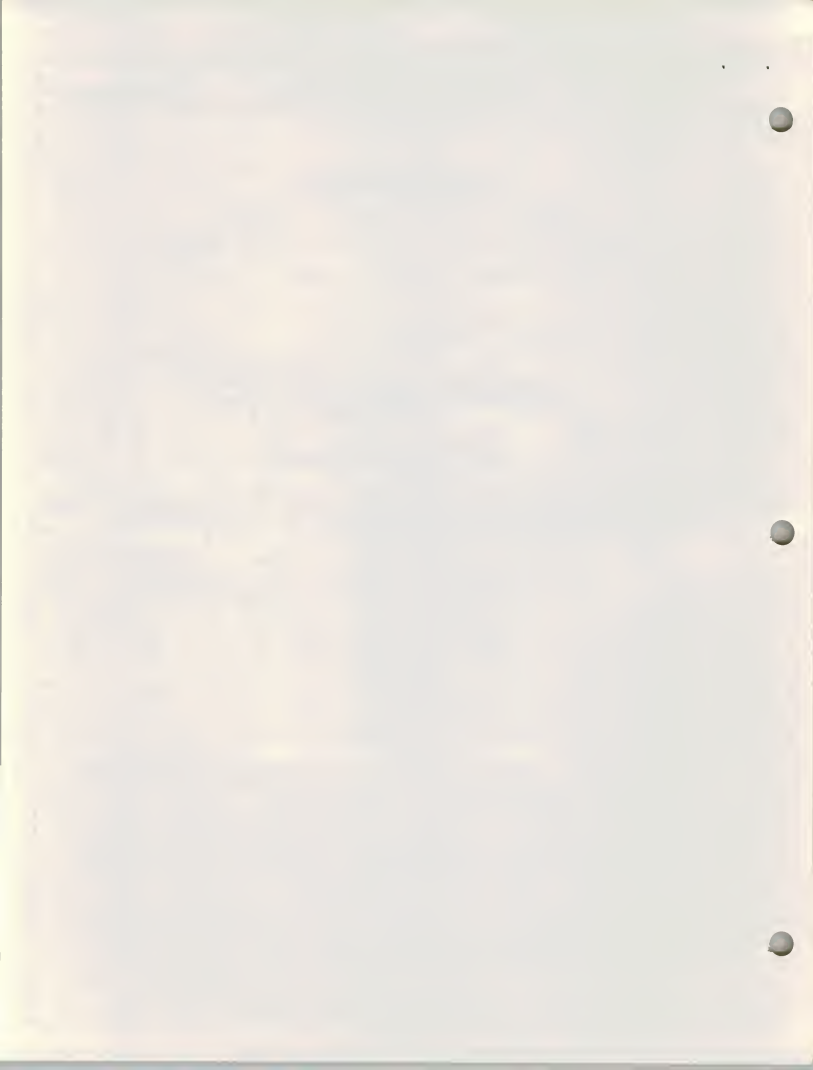
HORIZONTAL CURVE SPACING TABLE					
DEGREE OF CURVE	SPACING "A" ON CURVE	SPACING ON BOTH APPROACHES			
		B	C	D	E
0° TO 30°	200'	264'	264'	264'	264'
30° TO 1°	175'	264'	264'	264'	264'
1° TO 2°	125'	225'	264'	264'	264'
2° TO 3°	95'	170'	264'	264'	264'
3° TO 4°	80'	145'	240'	264'	264'
4° TO 6°	70'	125'	210'	264'	264'
6° TO 8°	55'	100'	165'	264'	264'
8° TO 12°	45'	80'	135'	264'	264'
12° TO 20°	35'	65'	115'	210'	264'
20° PLUS	25'	45'	75'	150'	264'

FIELD METHOD FOR DETERMINING DEGREE OF HORIZONTAL CURVES



NOTES:

- If distance E is 20 feet or more, add one regular "A" space as called for in the above table.
- See Standard Drawing No. 88-91 for Delineator Design Details.
- Post with delineators shall be placed on the right hand side facing oncoming traffic, 2'-0" clear from edge of shoulder or the face of curb, or as shown on the plans.
- Type I Delineator button shall be a nominal 3" diameter reflector as specified by Standard Specifications.
- Delineator spacing on Tangent, shall be 264', unless otherwise noted on project plans.
- Interstate highways shall be continuously delineated.
- Interstate highways with split alignments shall be delineated on the inside shoulder at double the normal spacing.
- Posts shall be installed behind guard rail posts where there is guard rail installed along the highway.
- Where, under normal spacing, a delineator post falls within a crossroad, that post may be moved in either direction a distance not to exceed one quarter of the normal spacing.
- Primary & secondary highways may be continuously delineated in areas where ground blizzards are prevalent or in areas of hazardous alignment; otherwise, curves of 4° and sharper shall be delineated on the outside of the curve. Where vertical alignment is rolling, horizontal curves less than 4° may require delineation.

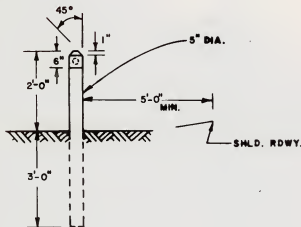


State Highway Commission
Helena, Montana

5" - WOOD GUIDE POST

Approved

State Highway Engineer



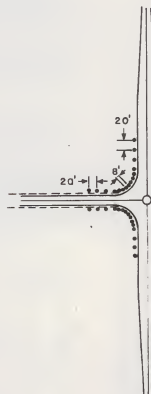
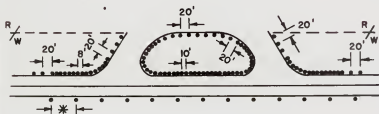
NOTES:

GUIDE POSTS TO BE OF 5" DIAMETER. WOOD POLE THAT CONFORMS TO THE APPLICABLE PROVISIONS OF THE STANDARD SPECIFICATIONS FOR ROAD & BRIDGE CONSTRUCTION. THE POLE SHALL BE TREATED IN SUCH A MANNER & WITH SUCH PRESERVATIVES THAT WILL ALLOW PAINT TO READILY ADHERE WITHOUT DISCOLORATION. (M-270.06(A)). THE PORTION ABOVE GROUND SHALL BE PAINTED WITH TWO COATS OF WHITE PAINT (M-280.04). REFLECTORIZATION OF GUIDE POSTS, IF REQUIRED IN PLAN SPECIFICATIONS, CAN BE ACCOMPLISHED BY APPLYING WHITE REFLECTORIZED PAINT ON TOP 6 INCH PORTION - OR - INSTALLATION OF DELINEATOR CRYSTALS AS SPECIFIED.

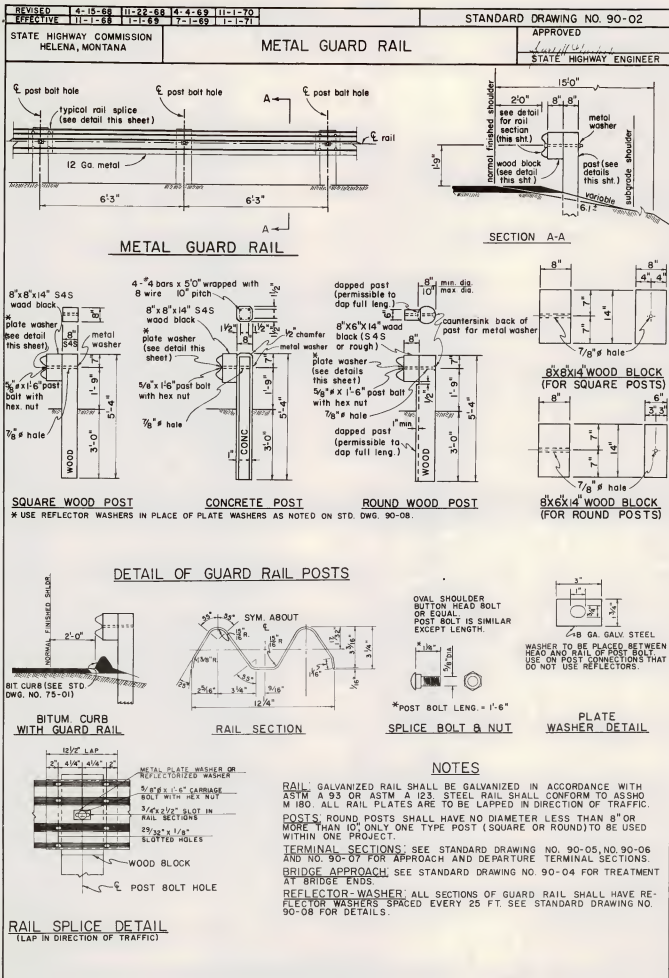
POST SPACING TO BE AS FOLLOWS:

RADIUS	SHLD. TANG. *	R/W TANG.
B' C TO C	10'	20'
C TO C	C TO C	C TO C

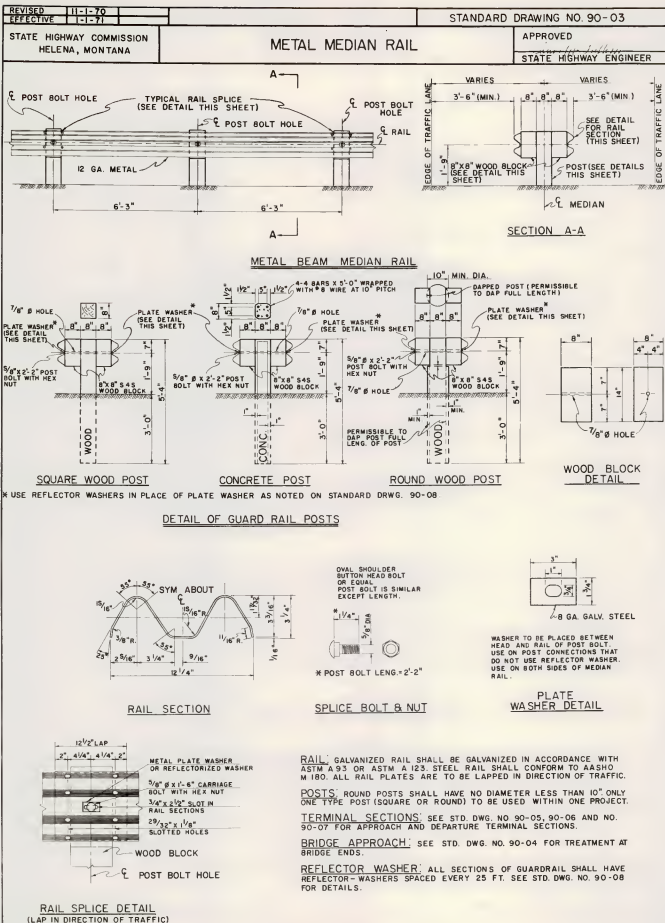
* DISTANCE VARIES - WILL BE NOTED IN PLANS



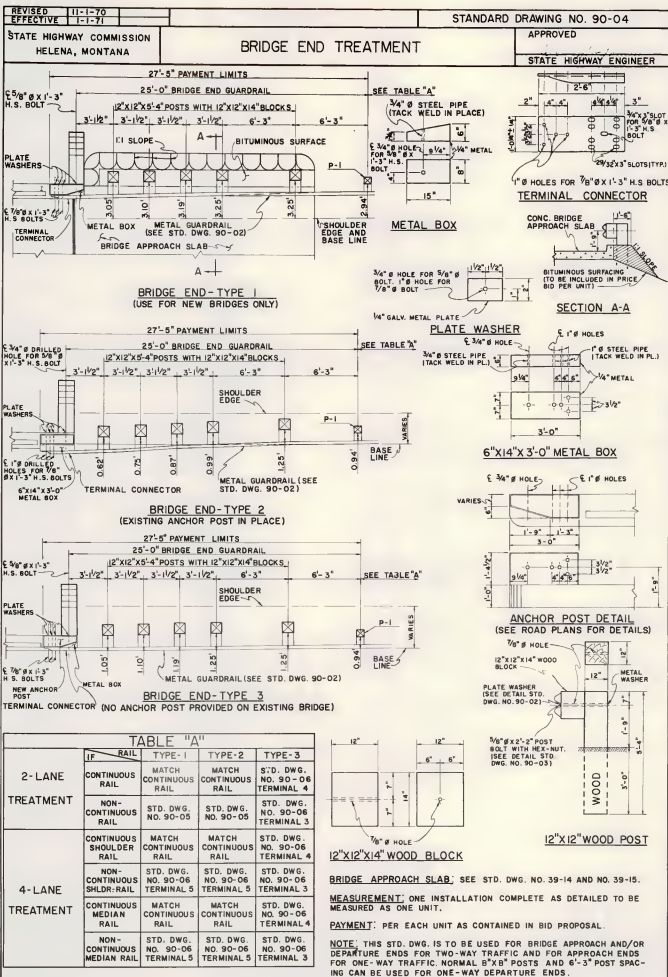






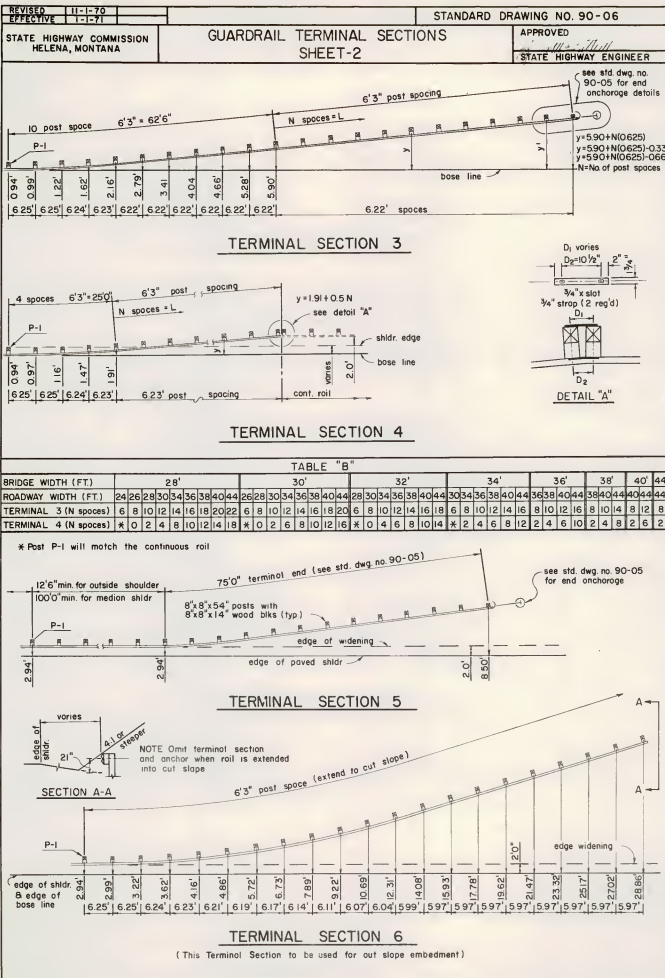




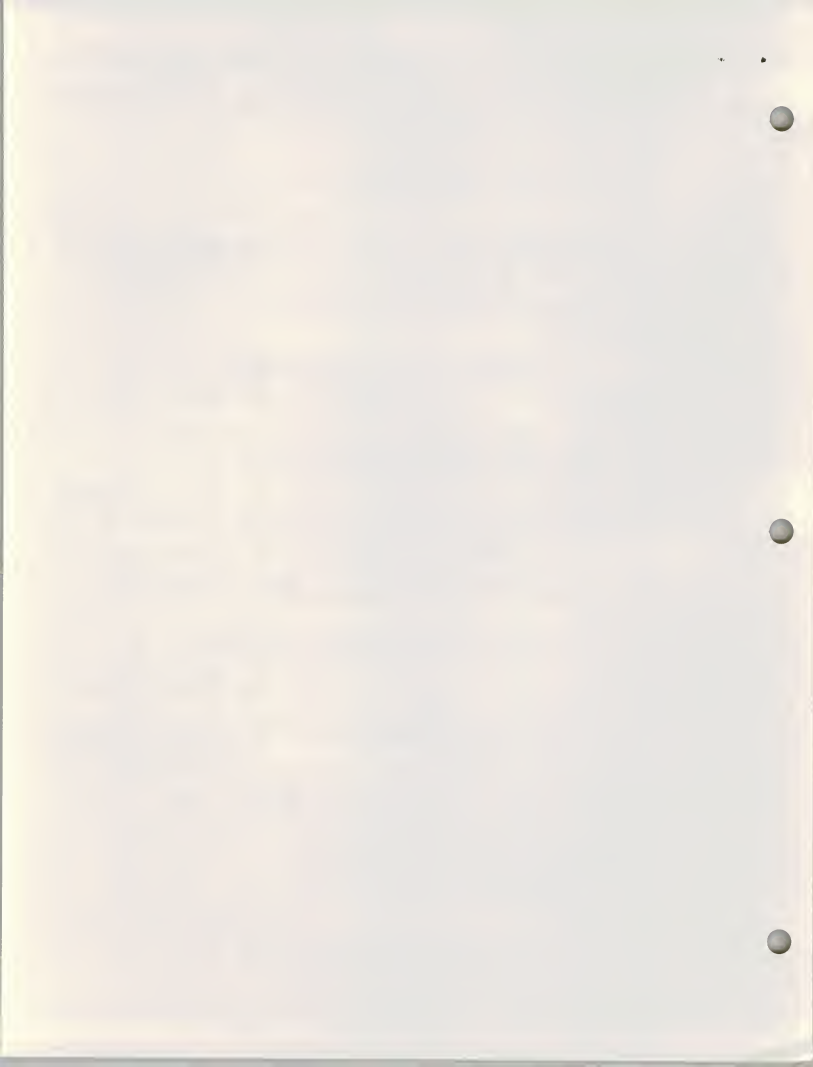












REVISED	11-1-70
EFFECTIVE	1-1-71

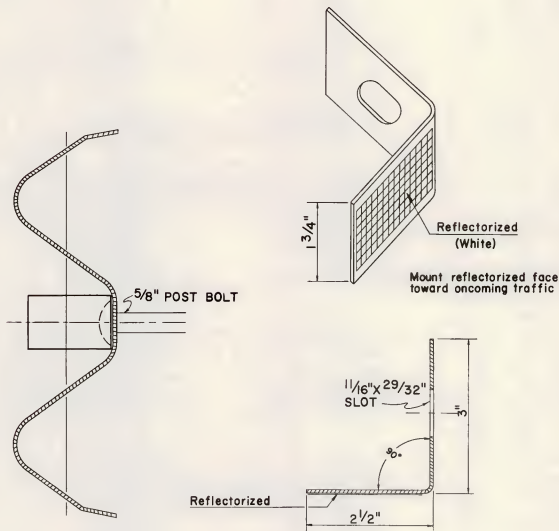
STANDARD DRAWING NO. 90-08

STATE HIGHWAY COMMISSION
HELENA, MONTANA

REFLECTOR - WASHER

APPROVED
James A. Sullivan
STATE HIGHWAY ENGINEER

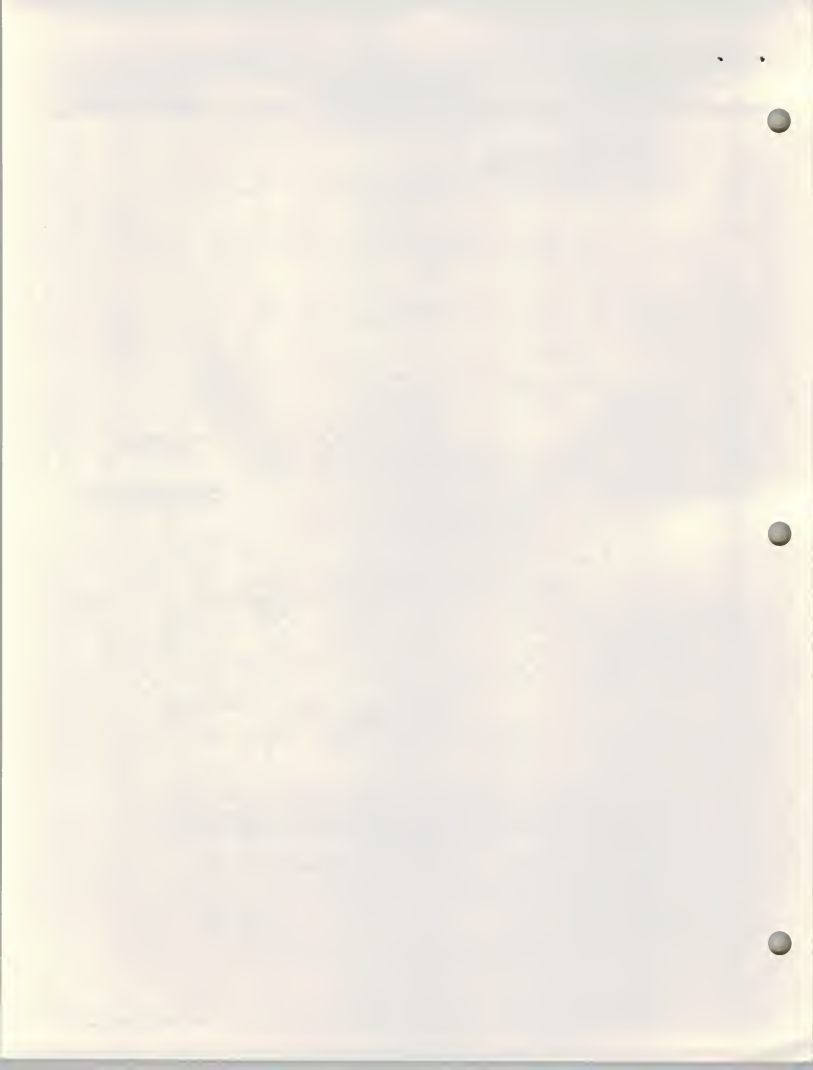
Material- 8 gage galvanized
approximate weight
0.47 lbs.



All sections of guard rail shall have reflector-washers installed every 25 ft. Reflector-washers are not required on bridge end, bridge pier or grade crossing protection guard-rail.

The use of reflectors will replace the need for the rectangular washers required to fasten rail to post.

Reflector-washers to be included in the unit price per linear foot of guard rail.



REVISED 11-1-67
EFFECTIVE 9-1-68

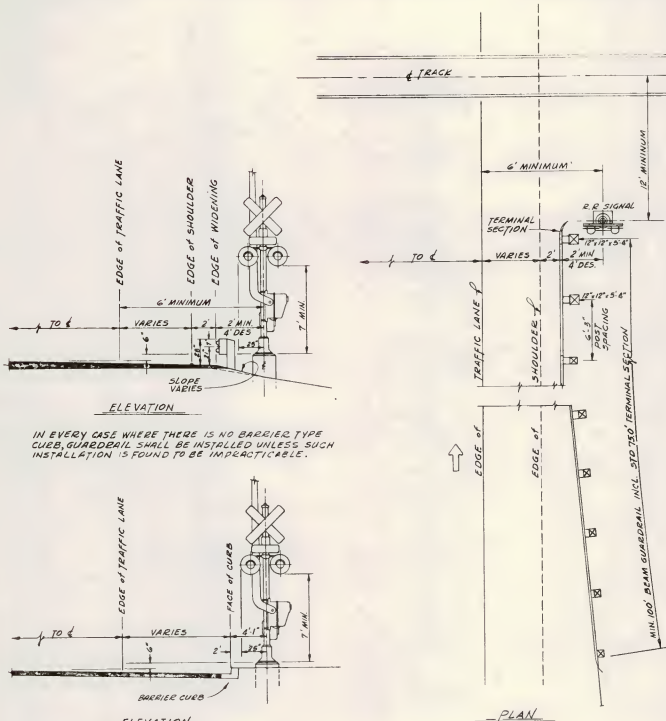
11-1-70
1-1-71

STANDARD DRAWING NO. 90-14

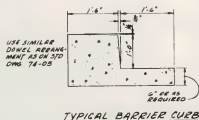
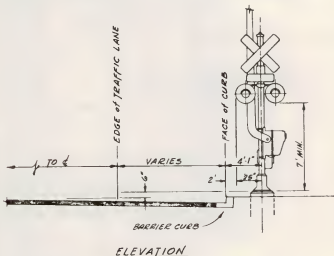
STATE HIGHWAY COMMISSION
HELENA, MONTANA

GUARDRAIL FOR GRADE CROSSING PROTECTION

APPROVED
P. J. WILSON
STATE HIGHWAY ENGINEER
7-18-67



IN EVERY CASE WHERE THERE IS NO BARRIER TYPE CURB, GUARDRAIL SHALL BE INSTALLED UNLESS SUCH INSTALLATION IS FOUND TO BE IMPRACTICABLE.



NOTE -
SEE BULLETIN NO. 6, "RECOMMENDED PRACTICES FOR RAILROAD - HIGHWAY GRADE CROSSING PROTECTION", ASSOCIATION OF AMERICAN RAILROADS, FOR ADDITIONAL DETAILS & SKETCHED CROSSINGS.

SEE STD DWG 90-05 FOR TERMINAL SECTION DETAILS.



CABLE GUARD RAIL

* * * * *

* DRAWING NO. 90-20 *

* *

* The CABLE GUARD RAIL Drawing No. 90-06 *

* effective 1-1-69 remains unchanged except for *

* the drawing number. Please change the number *

* on this drawing to 90-20 and insert in your *

* book in the proper sequence. *

* *

* * * * *

* * * * *

* DRAWING NO. 90-21 *

* *

* The CABLE GUARD RAIL DRIVEWAY ANCHOR SECTION *

* Drawing No. 90-07 effective 1-1-69 remains unchanged *

* except for the drawing number. Please change the *

* number on this drawing to 90-21 and insert in your *

* book in the proper sequence. *

* *

* * * * *



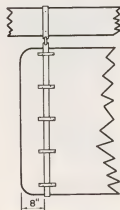
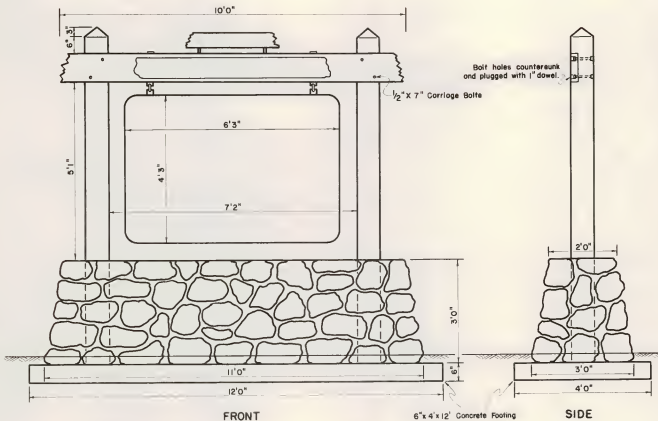
REVISED	11-16-70
EFFECTIVE	7-1-62

STANDARD DRAWING NO. 100-13

State Highway Commission
Helena, Montana

HISTORICAL MARKER

Approved
James W. Sullivan
State Highway Engineer



Detail for attaching hanging irons to back of sign panel.

Sign panel $5/4$ " Redwood doweled and glued. Lettering routed and painted white. Posts 8×8 " structure. Fir headpiece 3×10 " structure. Fir silhouette design routed in headpiece panel, posts and headpiece treated with Linseed Oil and wiped.

Base to be constructed of stone common to adjacent area.

